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INSTRUCTION BOOK

TRANSMITTER, RADIO UHF, CM-300 UT/CM-350 UT WITH REMOTE CONTROL CAPABILITY

TYPE FA-18001 CM-300 UT TYPE FA-18002 CM-350 UT

CONTRACT DTFA01-03-C-00035

CONTRACTOR
GENERAL DYNAMICS – DECISION SYSTEMS
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U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION

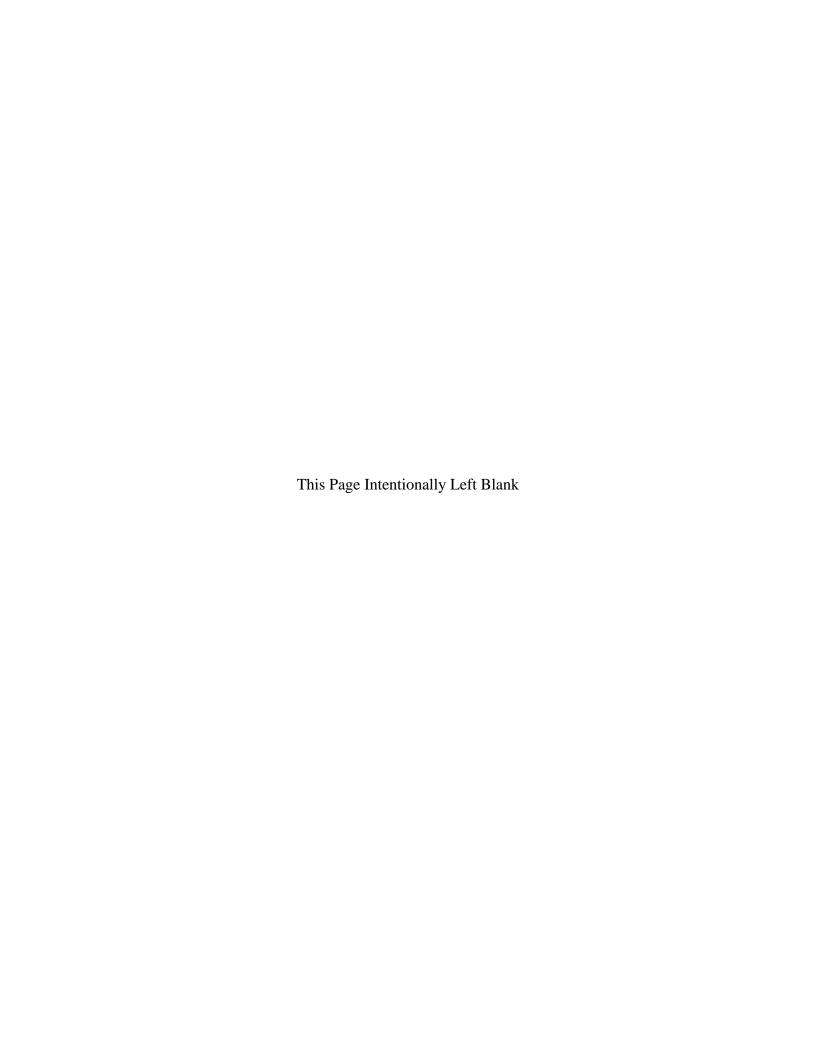


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SECTION 1 GENERAL INFORMATION AND REQUIREMENTS

- <u>0.1 INTRODUCTION</u>.- This section defines the purpose and scope of the Technical Instruction Book (TIB).
- <u>0.1.1 Purpose</u>.- This Technical Instruction Book contains information necessary to install, test, operate, and maintain the General Dynamics model CM-300 UT and CM-350 UT UHF Radio Transmitters.

0.1.2 Scope.-

- Section 1, General Information and Requirements, provides a brief description of the transmitter and describes the physical and functional characteristics.
- Section 2, Technical Description, provides simplified theory of operation supported by functional block diagrams.
- Section 3, Operation, describes the controls, indicators, and connectors and provides operating instructions.
- Section 4, Standards and Tolerances, provides pertinent equipment parameters, standard values, and tolerances.
- Section 5, Periodic Maintenance, provides a list of required maintenance and performance checks.
- Section 6, Maintenance Procedures, provides step-by-step procedures for the checks listed in Section 5.
- Section 7, Corrective Maintenance, provides warranty information and describes troubleshooting and removal/replacement procedures.
- Section 8, Parts List, provides a list of replaceable parts, their manufacturer, and part number.
- Section 9, Installation, Integration, and Checkout, provides procedures to install and integrate the transmitter in a system and align and verify operation.
- Section 10, Software, provides information on the installation and use of the Maintenance Data Terminal software (UHF MDT Software).
- Appendix A, Second Level Engineering Support and Warranty Service Procedure, provides information on how to obtain second level engineering support and instructions for returning failed LRUs under warranty.
- Appendix B, Glossary of Terms, Acronyms and Abbreviations.
- Appendix C, dBm Conversion Tables.

<u>0.1.3 Applicability.</u>- This instruction book applies to the General Dynamics model CM-300 UT and CM-350 UT UHF Radio Transmitters.

<u>1.1.4 CM-300 UT Versus CM-350 UT</u>.- The main differences between the CM-300 UT and CM-350 UT are as follows:

- The CM-300 UT has a 10 W Power Amplifier (PA) with an output power level adjustable from 2 watts to 10 watts.
- The CM-350 UT has a 50 W PA following the 10 W stage with an output power level adjustable from 10 watts to 50 watts.
- The CM-300 UT incorporates a switching Power Supply.
- The CM-350 UT incorporates a linear Power Supply.

These differences are illustrated by appropriate diagrams and are noted and described accordingly as they come up in the text. Unless specific applicability is noted, the information presented will apply to both the CM-300 UT and the CM-350 UT.

<u>0.2 EQUIPMENT DESCRIPTION.</u>- The General Dynamics model CM-300 UT and CM-350 UT UHF Radio Transmitters are UHF AM transmitters providing line-of-sight transmission of voice in the UHF frequency bands used in air traffic control operations. The transmitters can be used with AM receivers operating in the UHF frequency range of 225.000 to 399.975 MHz in 0.025 MHz tuning increments. They are designed for deployment in air traffic control, fixed-station environments, and provide ground-to-air voice communications.

The transmitter is contained in a rack mount housing with operating controls, audio input phone jack, and RS232 interface for a local Maintenance Data Terminal (MDT) located on the front panel. The antenna and receiver connector, remote interface connector, AC and DC power connectors, and RS232 interface for a remote MDT device are located on the rear panel.

The transmitter operating functions are microprocessor controlled. The operator can select the operating frequency, make adjustments, and monitor various transmitter functions using the MDT. The microprocessor monitors the MDT inputs, changes the configuration of the transmitter accordingly, and displays configuration information on the MDT.

The MDT may be a laptop PC with Windows 2000 or Windows NT Service Pack 6.0 operating system with UHF MDT software.

Figures 1-1 and 1-2 show the 10 Watt and 50 Watt transmitters respectively and Figure 1-3 illustrates a typical application using the MDT.



Figure 1-1. CM-300 UT UHF Transmitter



Figure 1-2. CM-350 UT UHF Transmitter

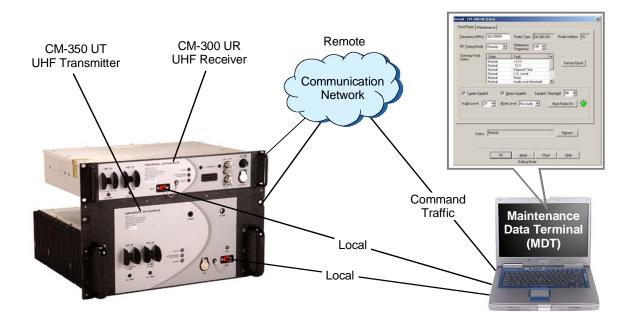


Figure 1-3. Typical System Arrangement with MDT

<u>0.3 RELATIONSHIP OF TRANSMITTER TO SYSTEM.</u> The transmitter can be connected to either an AC or DC power source, or both. The transmitter is used in a system in conjunction with a UHF receiver operating in the 225.000 to 399.975 MHz frequency range.

The receiver and transmitter can be connected to a common antenna, or each radio can be connected to its own discrete antenna. When connected to a common antenna, transmit/receive switching is handled internally by an electronic Antenna Transfer Relay (ATR) switch. During normal operation, Air Traffic Control (ATC) personnel can transmit and receive through the system via the Remote Audio inputs and outputs. Local headset and microphone connections are provided for use by support personnel.

An internal or external cavity filter may be used to manually tune the transmitter to the required frequency. The cavity filter will minimize interference in co-location arrangements. Alternatively, the cavity filter may be bypassed and tuning is accomplished remotely using the MDT.

Paragraphs 1.3.1 through 1.3.4 describe the use of a common antenna, the use of cavity filters, transceiver configurations, and transmitter/transmitter configurations. The abbreviations used in the Figures 1-4 through 1-8 mean the following:

ATR1 Connection to ATR connector 1 – NC (Normally Closed)

ATR2 Connection to ATR connector 2 – NO (Normally Open)

ATRC Connection to the ATR common connector – To antenna

CF1 Input connection to the internal filter

CF2 Output connection from the internal filter

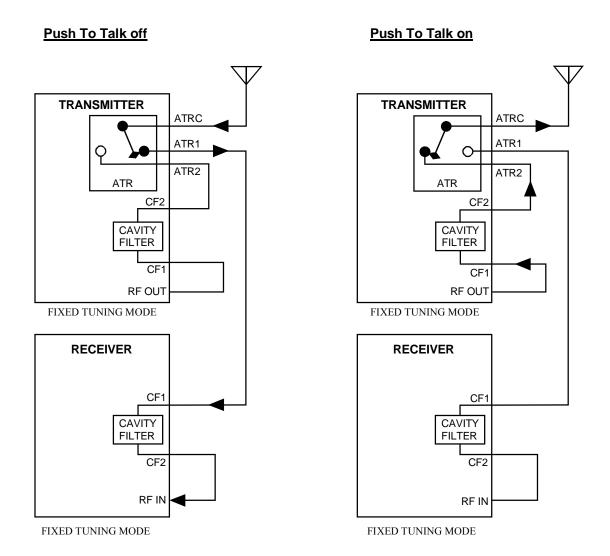
- 1.3.1 Using a Common Antenna. With PTT on, the ATR connects ATRC to ATR2 routing the transmit signal to the antenna. See Figure 1-4. With Push To Talk (PTT) off, the ATR connects ATRC to ATR1, routing incoming signals from the antenna to the receiver.
- 1.3.2 Using a Cavity Filter. The radios may be used either without a cavity filter, or with an internal cavity filter, or with an external cavity filter. The CM-300 UT and CM-350 UT cavity filter configurations are accomplished through appropriate external connections using jumper cables. See Figure 1-5.

Using an internal (or external) cavity filter is referred to as the Fixed Tuning Mode. In this mode, the RF output signal is routed through the cavity filter for manual tuning.

Remote Tuning Mode does not utilize an internal (or external) cavity filter. In this mode, the RF output signal bypasses the cavity filter and tuning is automatically accomplished when the frequency is changed through the MDT.

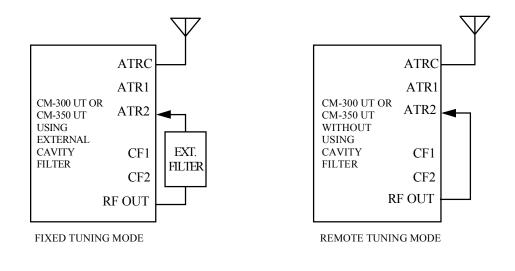
<u>1.3.3 Transmitter Stand Alone Configurations</u>.- Transmitter Stand Alone configurations are shown in Figure 1-5. In the stand alone configuration, the transmitter can be set up in the fixed or remote tuning modes.

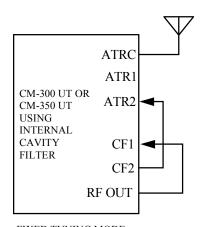
- <u>1.3.4 Transceiver Configurations.</u>- Transceiver configurations, i.e., transmitter and receiver sharing an antenna, are shown in Figures 1-6 and 1-7. Figure 1-6 provides cabling connections for Fixed Tuning Mode. Figure 1-7 provides cabling connections for Remote Tuning Mode.
- <u>1.3.5 Transmitter/Transmitter Configurations.</u>- Transmitter/Transmitter configurations, i.e., a main and standby transmitters sharing an antenna, are shown in Figure 1-8. The transmitter/transmitter configuration can be set up in the fixed or remote tuning mode.



NOTE: TRANSMITTERS AND RECEIVERS MAY USE EITHER AN INTERNAL OR EXTERNAL CAVITY FILTER

Figure 1-4. Transmit/Receive (Transceiver) Through Common Antenna





FIXED TUNING MODE

Figure 1-5. CM-300 UT/CM-350 UT Stand Alone Configurations

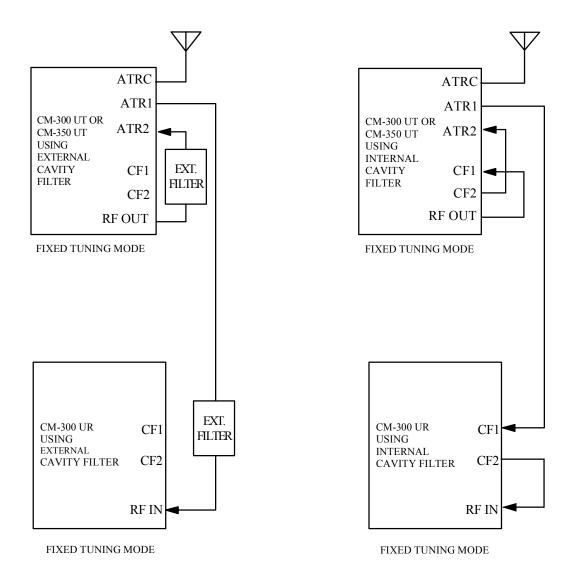


Figure 1-6. Transceiver Configurations, CM-300 UT/CM-350 UT With CM-300 UR in Fixed Tuning Mode

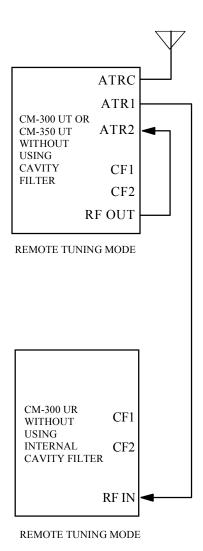
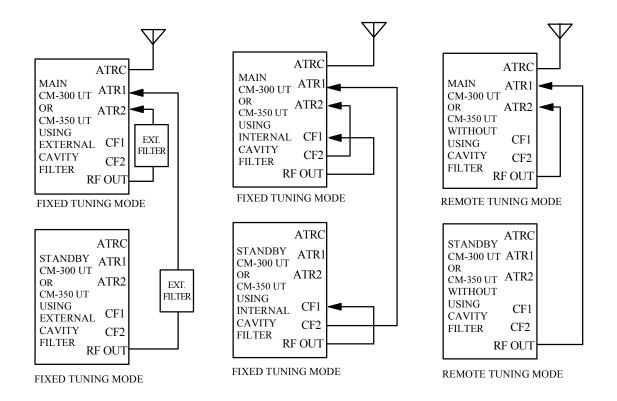


Figure 1-7. Transceiver Configurations, CM-300 UT/CM-350 UT With CM-300 UR in Remote Tuning Mode



NOTE: IN A MAIN/STANDBY CONFIGURATION, DO NOT MIX CM-300 UTs WITH CM-350 UTs

Figure 1-8. Transmitter/Transmitter in Main/Standby Configurations

<u>0.4 EQUIPMENT SPECIFICATION DATA</u>.- The operating parameters of the UHF transmitter are listed in Table 1-1; the physical characteristics are listed in Table 1-2; and the environmental data in Table 1-3.

Table 1-1. Operating Parameters

Condition	Specification			
	CM-300 UT	CM-350 UT		
Frequency Range	UHF - 225.000 to 399.975 MHz	UHF - 225.000 to 399.975 MHz		
Tuning Increments	25 kHz, 7,000 available channels	25 kHz, 7,000 available channels		
Frequency Stability	<±2ppm (for 1 year)	±2ppm (for 1 year)		
Modulation	AM	AM		
Occupied Bandwidth	99% power in < 25 kHz bandwidth	99% power in < 25 kHz bandwidth		
Primary Power				
AC Voltage	120 V (± 10%), 60 Hz (±3 Hz)	120 V (± 10%), 60 Hz (±3 Hz)		
AC Current	2.0 Amps maximum (keyed)	8.0 Amps maximum (keyed)		
	0.2 Amps typical (unkeyed)	0.4 Amps typical (unkeyed)		
DC Voltage	+21 to +29 VDC	+21 to +29 VDC		
DC Current	10.0 Amps maximum (keyed)	20.0 Amps maximum (keyed)		
	1.0 Amps typical (unkeyed)	1.0 Amps typical (unkeyed)		
RF Power Output	10 W CW - Adjustable 2-10 W	50 W CW - Adjustable 10-50 W		
Output Impedance	50 ohm nominal	50 ohm nominal		
Harmonic Output	> -80 dBc at full carrier output, 1 kHz modulation at 90%	> -80 dBc at full carrier output, 1 kHz modulation at 90%		
Spurious Output	> -89 dBc at ≥ 500 kHz offset	$>$ -89 dBc at \geq 500 kHz offset		
Distortion	< 10% at 90% modulation for audio 300 Hz to 3000 Hz	< 10% at 90% modulation for audio 300 Hz to 3000 Hz		
Carrier Noise Level	> 40 dB below 1 kHz, 90% modulation reference	> 40 dB below 1 kHz, 90% modulation reference		
Audio Input	600 ohm balanced, -25 dBm to +20 dBm	600 ohm balanced, -25 dBm to +20 dBm		
Keying Time	< 30 msec	< 30 msec		

Table 1-2. Physical Characteristics

	Specification		
Characteristic	CM-300 UT	CM-350 UT	
Unpacked			
Height	5.25 inches	8.75 inches	
Width	19 inches (rack mount)	19 inches (rack mount)	
Depth	17.4 inches	17.4 inches	
Weight	< 37 pounds	< 60 pounds	
Packed for Shipping			
Height	10 inches	14 inches	
Width	21 inches	21 inches	
Depth	21 inches	21 inches	
Weight	< 43 pounds	< 66 pounds	
Volume	2.55 cu. ft.	3.57 cu. ft.	

Table 1-3. Environmental Data

Characteristic	Specification	
	CM-300 UT	CM-350 UT
Temperature (Operating)	-10°C to +50°C	-10°C to +50°C
Temperature (Storage)	-40°C to +70°C	-40°C to +70°C
Relative Humidity (Operating)	5 to 90%	5 to 90%
Relative Humidity (Storage)	Up to 100%	Up to 100%
Altitude (Operating)	15,000 feet, MSL (Mean Sea Level)	15,000 feet, MSL
Altitude (Storage)	0-50,000 feet	0-50,000 feet
Warm-up Time	Meets full specifications within 30 seconds after turn-on	Meets full specifications within 30 seconds after turn-on

<u>0.5 EQUIPMENT AND ACCESSORIES SUPPLIED</u>.- The equipment listed in Table 1-4 makes up the complete transmitter package and is shipped as a unit.

Table 1-4. Equipment Supplied

	71-4. Equipment Supplie		Manufacturer Part Number (NSN)	
Qty.	Item	Description	CM-300 UT	CM-350 UT
1	CM-300 UT	UHF transmitter, 10 W	01-P40400G001 (5895-01-505-7139)	
	CM-350 UT	UHF transmitter, 50 W		01-P40200G001 (6030-01-505-7163)
1	Instruction Book	Technical Instruction Book (TI6610.20)	68-P40408G (7610-01-511-7744)	68-P40408G (7610-01-511-7744)
1	CM-300 UT KIT	Contains the items below	67-P40460G001	
	CM-350 UT KIT	Contains the items below		67-P40260G001
2	-Jumper Cables	Jumper cables for connecting different cavity filter configurations and chaining to a common antenna.	30-P40236G001	30-P40236G001
1	-AC Power Cable		0EM-0299	0EM-0299
1	-DC Power Cable		30-P30121P002	30-P30121P003
1	-Slide Package	Contains two pairs of slides and all necessary mounting hardware for mounting the slides to the rack mounting brackets and radio.	CC7502-00-0160	CC7502-00-0160
	-Interface Connector Mating Receptacle Kit	DB-15		
1	Receptacle		205205-2	205205-2
15	Contact	Socket contacts	66504-9	66504-9
1	Backshell		207908-4	207908-4
	-MDT Connector Mating Plug Kit	DB-9		
2	Plug		205204-3	205204-3
18	Contact	Pin contacts	66506-9	66506-9
2	Backshell		207908-1	207908-1

<u>0.6 EQUIPMENT REQUIRED BUT NOT SUPPLIED.</u> The equipment listed in Table 1-5 is needed for installation, maintenance and other functions described in subsequent sections. These items are not supplied with the transmitter.

Table 1-5. Equipment Required but not Supplied

Qty	Item	Manufacturer	Part Number	NSN
1	Modulation Analyzer	Agilent	8901, or equivalent	
1	Oscilloscope	Tektronix	465, or equivalent	
1	Function Generator	Agilent	8904, or equivalent	
1	Frequency Counter	Hewlett Packard	5385A, or equivalent	
1	Wattmeter	Bird	43, or equivalent	
1	Dummy load (100 W)	JFW	50T-032-1:1, or equivalent	
1	Microphone	Telex	M85/U carbon microphone, or equivalent	
1	Audio Analyzer	Agilent	8903E, or equivalent	
1	20 dB Attenuator (100 W)	JFW	50FH-020-100, or equivalent	
1	Crimping Tool	AMP	58448-2, or equivalent	5120-01-361-8970
4	Rack Mounting Brackets	Jonathan Engineering Solutions	SPO-551, or equivalent	5340-01-242-5172
1	MDT Terminal	Commercial	Laptop PC with Windows 2000 or Windows NT Service Pack 6.0, or equivalent	
1	UHF MDT Software	General Dynamics	99-P40681G	7025-01-505-7164
1	Allen Wrench ¹ / ₄ Inch Hex	Xcelite	LN-28	

SECTION 2 TECHNICAL DESCRIPTION

- 2.1 INTRODUCTION.- This section describes the theory of operation of the CM-300 UT (10 W) and CM-350 UT (50 W) transmitters. The theory of operation is supported by the simplified block diagrams shown in Figures 2-1 and 2-2, and the detailed block diagrams shown in Figures 2-3 and 2-4. Figures 2-1 and 2-3 pertain to the CM-300 UT transmitter and Figures 2-2 and 2-4 pertain to the CM-350 UT transmitter.
- <u>2.1.1 CM-300 UT Versus CM-350 UT.</u> The main differences between the CM-300 UT and CM-350 UT are as follows:
 - The CM-300 UT has a 10 W Power Amplifier (PA) with an output power level adjustable from 2 watts to 10 watts.
 - The CM-350 UT has a 50 W PA following the 10 W stage with an output power level adjustable from 10 watts to 50 watts.
 - The CM-300 UT incorporates a switching Power Supply.
 - The CM-350 UT incorporates a linear Power Supply.

These differences are illustrated in the Figures 2-1 through 2-4 and are noted and described accordingly as they come up in the text. Unless specific applicability is noted, the information presented will apply to both the CM-300 UT and the CM-350 UT.

2.2 SIMPLIFIED THEORY OF OPERATION.- The UHF transmitter is intended for ground-to-air voice communications. It is designed to operate in the UHF range from 225.000 MHz to 399.975 MHz with 7000 channels spaced 25 kHz apart. The CM-300 UT transmitter provides up to 10 watts, 90 percent modulated signal output. The CM-350 UT transmitter provides up to 50 watts, 90 percent modulated signal output. The block diagrams illustrate the basic operation of the transmitter. The transmitter is controlled by a MC9S12A256 microprocessor. At turn-on, the microprocessor determines the operating frequency of the unit from stored data, and programs the synthesizer to the required operating frequency (f_0).

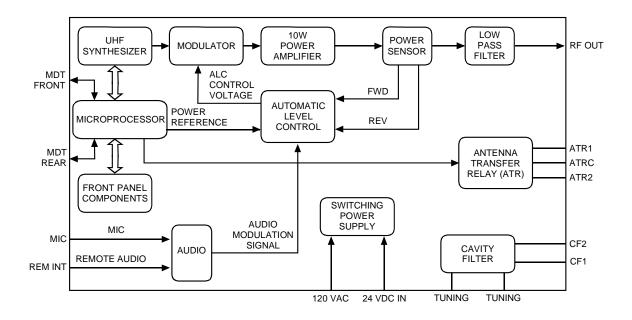


Figure 2-1. CM-300 UT Transmitter Simplified Block Diagram

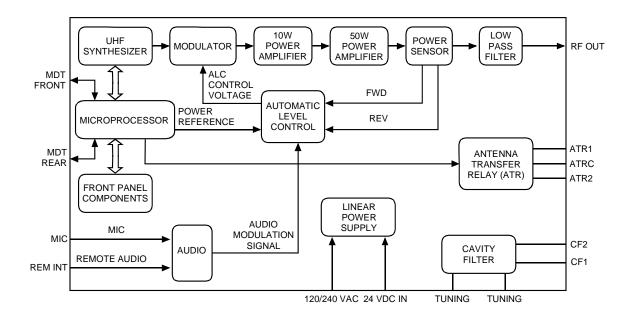


Figure 2-2. CM-350 UT Transmitter Simplified Block Diagram

- <u>2.2.1 Fixed/Remote Operation.</u>- Fixed tuning mode or remote tuning mode is selectable at the Maintenance Data Terminal (MDT). In the fixed mode, the RF output signal is routed through the cavity filter for manual tuning. In the remote mode, the RF output signal bypasses the cavity filter and tuning is automatically accomplished when the frequency is changed through the MDT (see Section 1.3.2). In either mode, the transmitter is tunable from 225.000 to 399.975 MHz.
- <u>2.2.2 Cavity Filter</u>.- The cavity filter is a user-configurable 1 MHz wide filter. See Figures 1-4 through 1-8. The cavity filter is manually tuned to the desired transmitter frequency and is used in the Fixed Tuning Mode.
- <u>2.2.3 ATR Switch.</u>- The Antenna Transfer Relay (ATR) switch handles transmit/receive switching when two UHF radios are connected to the same antenna. See Section 1.3.1 and Figures 1-4 through 1-8.
- 2.2.4 UHF Synthesizer.- The UHF Phase-Locked-Loop (PLL) Synthesizer, with a frequency range of 225.000 MHz to 399.975 MHz, generates the transmit RF signal. The microprocessor supplies the data to select the proper frequency which can be adjusted in 25 kHz steps. A 16.8 MHz reference oscillator provides the synthesizer integrated circuit (IC) with a frequency reference signal that it divides internally to produce the appropriate loop reference frequency. A sample of the RF output from the Voltage Controlled Oscillator (VCO) is buffered and fed back to the synthesizer. This signal passes through the synthesizer chip's internal pre-scalar and is divided to match the frequency of the loop reference signal. Both signals are applied to the internal phase comparator which compares the phase of signals. The phase comparator translates any difference in phase between the signals into an error current. The error current signal is filtered and scaled to produce a tuning voltage for the VCO, to correct any error in the frequency of oscillation. Together, the synthesizer IC, loop filter, and VCO form a phase-locked loop that generates RF signals with a frequency accuracy of better than 2 parts per million (<± 2 Hz for every MHz). The UHF synthesizer output is a fixed gain amplifier that isolates the VCO from load changes in the Modulator.

When the loop is locked onto the proper frequency, the synthesizer provides a lock detect signal to the microprocessor indicating that the synthesizer is locked on frequency. If the microprocessor does not receive this lock signal, it disables the transmitter and sends an error message to the MDT and front panel indicators. When the transmitter is in the idle mode (not keyed), the microprocessor programs the synthesizer to 400 MHz. This prevents any in-band leakage of signal out of the synthesizer.

<u>2.2.5 Voltage Controlled Attenuator</u>. The Voltage Controlled Attenuator (VCA) receives the synthesizer signal and adjusts the level of the signal to control the overall transmitter output power. The level out of the VCA is a function of the Automatic Level Control (ALC) voltage. The ALC voltage causes the VCA to attenuate more or less of the signal out of the synthesizer, which ultimately adjusts the transmitter power output. Amplitude modulation of the signal also happens in the VCA. The audio modulation signal is superimposed upon the ALC voltage causing the level out of the VCA to vary in response to the audio.

The signal passes through a pad and an isolation amplifier, to further isolate the Synthesizer VCO from load changes in the VCA, and on to the PIN diode attenuator. The attenuator has both a series path and a shunt path for signal. The forward resistance of the PIN diodes in each path, which is a function of the ALC voltage, determines how much signal flows through each path. If the ALC voltage is high, the forward resistance of the series path will be low and the

forward resistance of the shunt path will be high. Therefore most of the signal passes through the attenuator to the power amplifier and very little signal is shunted to ground. This means a higher power out of the transmitter. If the ALC voltage is low, the forward resistance of the shunt path will be low and the forward resistance of the series path will be high. Therefore most of the signal is shunted to ground and very little passes through the attenuator. This means less power out of the transmitter.

After the attenuator sets the proper amount of signal output, the signal passes through a voltage controlled amplifier whose gain is controlled by the ALC control voltage. This gives additional power output level control.

When the transmitter is not transmitting, the microprocessor forces the ALC voltage to minimum. This sets the VCA to maximum attenuation and the variable gain amplifier to minimum gain to minimize any leakage of signal out of the transmitter.

<u>2.2.6 Power Amplifier.</u>- The Power Amplifier (PA) circuit amplifies the signal received from the Modulator. The fixed gain power amplifier is capable of providing 70 watts (peak) at the output of the PA. This provides the margin required to prevent the amplifier from saturating during modulation.

The PA bias network provides the DC bias for the amplifiers. When the unit is not transmitting, the microprocessor disables the bias network and shuts the power amplifier off to minimize any leakage signal out of the transmitter.

The microprocessor also monitors the temperature of the amplifiers. If the temperature exceeds a safe level, the microprocessor sets the power out of the VCA to half power. This results in less drive to the power amplifier, and it will cool. The microprocessor will restore full power output when the power amplifier cools sufficiently.

- 2.2.7 50 W Power Amplifier (CM-350 UT only).- The 50 W Power Amplifier is a 4-stage design. The signal from the driver stage is divided into 4 separate paths. Each path is individually amplified and recombined into a single output. This design is capable of supplying 325 W (peak) providing the margin required to prevent the amplifier from saturating during modulation. The 4-stage amplifier design is contained within the Automatic Level Control (ALC) loop.
- <u>2.2.8 Power Sensor</u>.- The Power Sensor is a bi-directional coupler with detector outputs which detect the level of forward and reflected power. The Automatic Level Control (ALC) circuit monitors the voltages out of the detector.
- <u>2.2.9 Low Pass Filter.</u>- The Low Pass Filter (LPF) stage provides suppression of the transmitter harmonics.
- 2.2.10 Automatic Level Control Circuit. The Automatic Level Control (ALC) circuit controls the amount of attenuation in the Voltage Controlled Attenuator (VCA) and therefore sets the transmitter power output. When the operator adjusts the power out from the MDT, the microprocessor changes the gain on the amplifier involved in setting power out. This directly affects the ALC voltage to the VCA, which sets the power out to the desired level.

The audio modulation is also summed into the ALC voltage at the input to the power control amplifier. This causes the level out of the VCA to vary at the audio rate and thus produce an amplitude modulated signal. When the operator adjusts the modulation percentage from the

MDT, the microprocessor adjusts the resistance of the % MOD potentiometer, which changes the amount of audio signal that is summed into the ALC voltage (less audio summed means lower percentage modulation).

The ALC circuit also monitors the detected forward and reverse power levels (VF and VR) and sums the voltages with the ALC control voltage. This has two effects. One, if the power output starts to drift up or down from the set level, the ALC control voltage changes which causes the VCA to correct for the drift. Two, if the reflected power increases to too great a level, indicating a poor impedance match at the antenna output, the ALC control voltage will cause the VCA to attenuate more which reduces the power out and protects the power amplifiers.

<u>2.2.11 Audio</u>.- The audio stage filters, amplifies and adjusts the level of the input audio signals before routing them to the ALC circuit. The transmitter has two audio inputs, a 600 ohm, balanced, remote audio input and a local microphone (MIC) audio input.

Audio priority is determined by which push-to-talk (PTT) signal is used.

- MIC Audio MIC PTT
- Remote Audio VOLTAGE PTT, CURRENT PTT, or MDT PTT
- REMOTE has priority over MIC

The level of audio out of the amplifier is controlled by the amplifier feedback loop. The detector samples the amplifier output and converts the signal to a DC voltage which controls the gain control element. This in turn controls the audio amplifier gain. As the amplifier output level rises, the gain of the amplifier is reduced to compensate. In this manner, the audio amplifier output level remains fairly constant for input signals from -25 to +20 dBm. After the gain controlled amplification, the signal passes through isolation amplifiers and a limiter circuit. The limiter clips very large input signals that are outside the range of the audio AGC circuit and prevents overmodulation of the transmitter signal. Finally, the signal is filtered by high and low-pass active filters to limit the audio passband.

The transmitter operates on a "ground key" system. If the microprocessor detects a ground on the MIC key or remote key line, the transmitter enters the transmit mode. If no key is detected, the transmitter will be in the idle mode as described earlier. A 9.0 volt regulator provides power to the MIC "ring" line which will power a carbon type MIC.

<u>2.2.12 Microprocessor.</u> The main component of the controller is the microprocessor. The microprocessor controls all transmitter functions based on user inputs. User inputs are entered through the MDT. The microprocessor programs the transmitter frequency and power output, and monitors transmitter power supplies and other operations. It provides tuning data through a serial interface to the UHF synthesizer and monitors the synthesizer lock indicator.

The microprocessor monitors the key line logic circuits and configures the unit in the transmit mode if a key is detected. The transmit line, power amp enable line, ATR line, and ALC disable line control switching between the transmit and idle modes. The transmit indicator line lights the front panel XMT LED when the unit is in the transmit mode.

<u>2.2.13 Front Panel Components.</u>- The Front panel components consist primarily of the AC/DC power switches, failure and alert/alarm indicators, microphone jack, the MDT local connector, and cavity filter tuning adjustment controls. The MDT connector provides the user interface for the microprocessor. The MDT controls the functions of the microprocessor

and provides the feedback from the microprocessor to the user. The AC/DC power switches control the application of AC and DC voltage to the power supply circuits. See Section 3 for detailed description of controls and indicators.

<u>2.2.14 CM-300 UT Power Supply.</u>- The CM-300 UT is a switching Power Supply. It converts the primary 120 VAC or 24 VDC input to ± 12 VDC, ± 5 VDC, ± 26 VDC, ± 8 VDC. The transmitter operates on 120 VAC and automatically switches to ± 24 VDC if the AC line voltage sags or is lost. Both AC and DC inputs are fuse protected.

The CM 300 UT Power Supply consists of an AC and a DC portion. The 120 VAC is converted, via a 125 kHz AC-to-DC chopping converter to 26 VDC to be compatible with the + 24- VDC input requirements. Then a DC-to-DC Converter is driven by either the direct 24 VDC input or the converted 26 VDC from the AC converter section. The outputs from the DC-to-DC converter provide +26 Volts and series regulators from the 26 Volts provide two DC voltages of +12 Volts, +5 Volts. An inverter runs from the +12 Volt regulator to generate -12 Volts from which a zener shunt regulator provides -8 Volts. Additional regulation and voltages are supplied with internal regulators not shown in the Power Supply block in Figure 2-3.

<u>2.2.15 CM-350 UT Power Supply</u>.- The CM-350 UT incorporates a linear Power Supply. It converts the primary 120 VAC or 24 VDC input to ± 12 VDC, ± 5 VDC, ± 26 VDC, ± 8 VDC. The transmitter operates on 120 VAC and automatically switches to ± 24 VDC if the AC line voltage sags or is lost. Both AC and DC inputs are fuse protected.

Rather than the AC-to-DC switching power supply concept utilized in the 10-Watt transmitter, the 50-Watt transmitter uses a linear supply that full-wave rectifies the transformed 60-Hz line signal and filters it to provide 26 VDC out. From this point, the power control is similar to the CM-300 UT Power Supply. There is a distribution section that selects the rectified/filtered AC or +24 VDC. This output, shown as +26 V in the Power Supply block, provides the higher voltage output to drive the power amplifier stages. Series regulators and an inverter as shown in Figure 2-4, provide the additional voltages of +12 V, +5 V, -8 V, and -12 V.

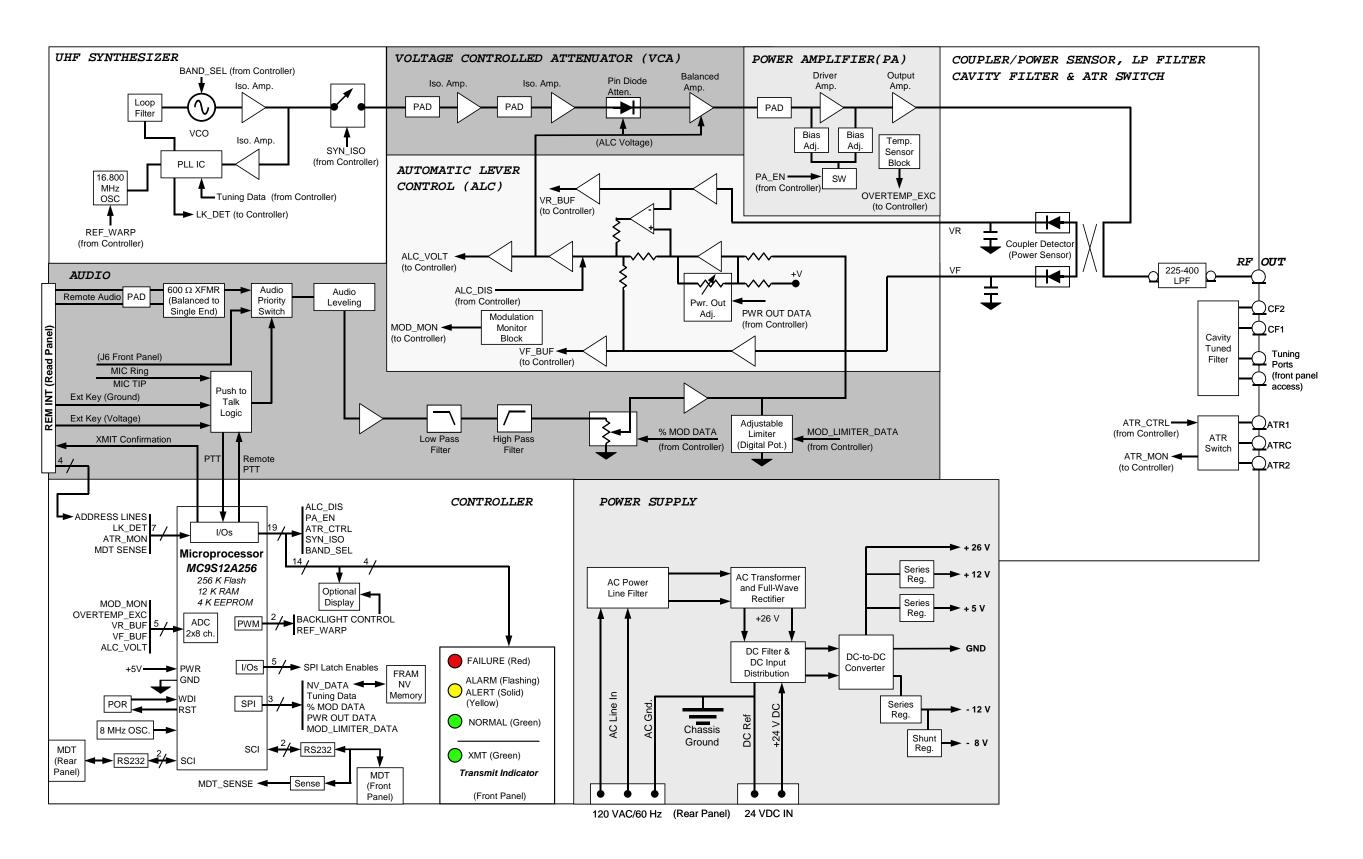


Figure 2-3. CM-300 UT Transmitter Detailed Block Diagram

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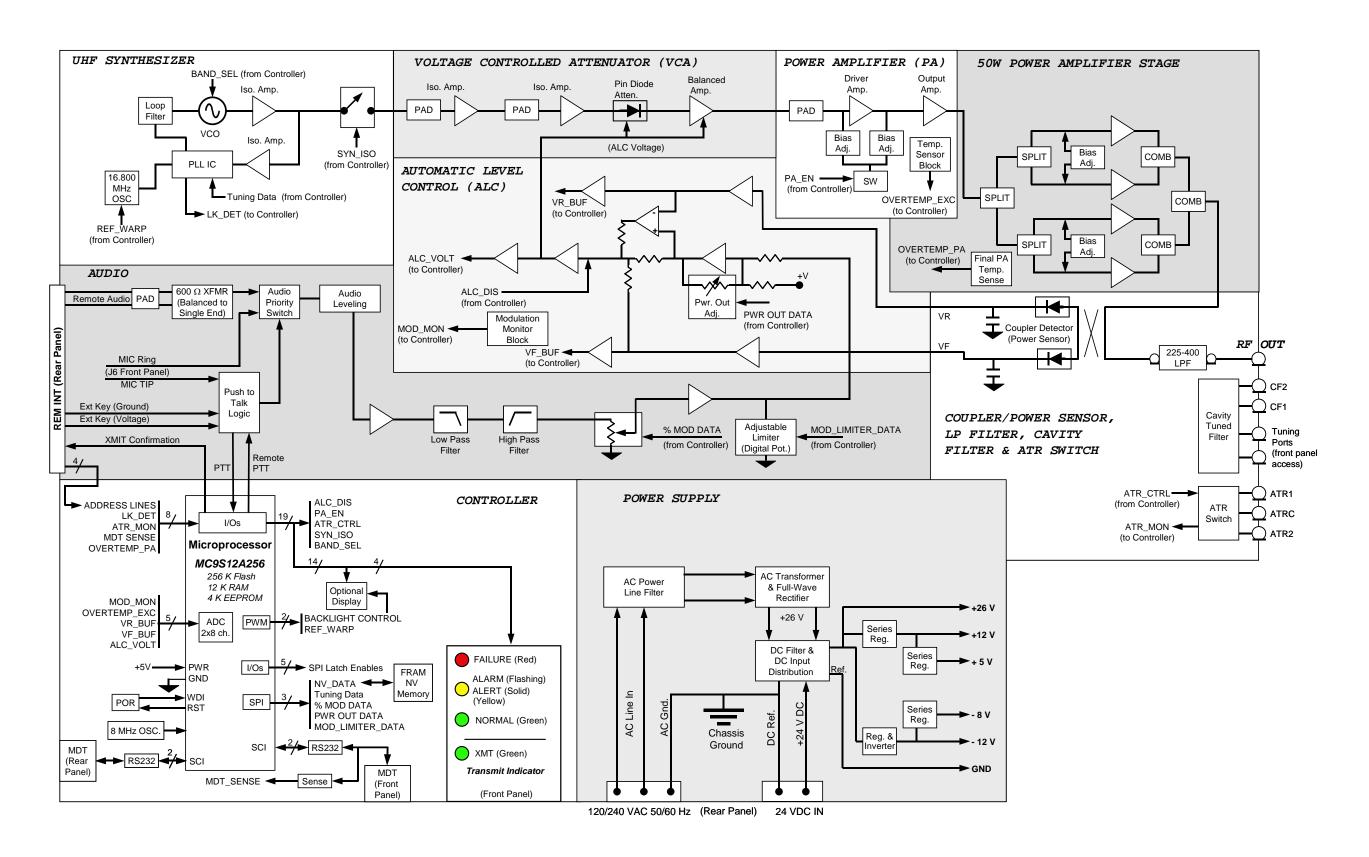


Figure 2-4. CM-350 UT Transmitter Detailed Block Diagram

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SECTION 3 OPERATION

<u>3.1 INTRODUCTION</u>.- The following paragraphs provide information for operating the General Dynamics model CM-300 UT and CM-350 UT UHF Radio Transmitters. Included are

- Descriptions of all controls, indicators, and connectors.
- Connector interface pin outs.
- Operational description of the front panel status indicators (NORMAL, FAILURE, ALARM/ALERT), and Microphone.
- MDT operation.
- Transmitter start-up and operation.
- Equipment shutdown.
- Emergency operation.

- <u>3.2 CONTROLS, INDICATORS, AND CONNECTORS.</u>— This section describes all controls, indicators, and connectors.
- 3.2.1 CM-300 UT Front Panel Controls, Indicators, and Connectors. The CM-300 UT front panel controls, indicators and connectors are shown in Figure 3-1 and explained in Table 3-1.

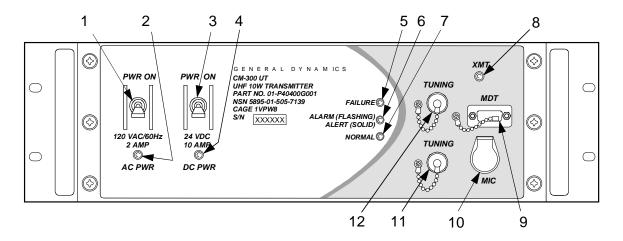


Figure 3-1. CM-300 UT Front Panel Controls, Indicators, and Connectors

Table 3-1. CM-300 UT Front Panel Controls, Indicators, and Connectors

Index No.	Controls, Indicators, Connectors	Туре	Function	
1	PWR ON	Switch	Switches ON or OFF the 120 VAC power	
	120 VAC/60 Hz 2 AMP		source.	
2	AC PWR	Green LED Indicator	Lit when AC power is applied to the transmitter.	
3	PWR ON	Switch	Switches ON or OFF the 24 VDC power	
	24 VDC 10 AMP		source.	
4	DC PWR	Green LED Indicator	Lit when DC power is applied to the transmitter.	
5	FAILURE Red LED Indicates 3 types of failures. See 3-10.		Indicates 3 types of failures. See Table 3-10.	
6	ALARM (FLASHING)	Yellow LED	Indicates 9 types of alarms. See Table 3-11.	
	ALERT (SOLID)	Indicator	Indicates 3 types of alerts. See Table 3-11.	
7	NORMAL	Green LED Indicator	Lit when the transmitter is operating correctly.	
8	XMT	Yellow LED Indicator	Lit when the transmitter is being keyed.	
9	MDT	DB-9	RS232 interface to local MDT device. See Section 3.2.5.2.	
10	MIC	Phone Jack	Connection for Microphone for local audio input.	
11	TUNING (lower)	Rotary 0.25 inch HEX adjustment	Adjusts the tunable cavity filter.	
12	TUNING (upper)	Rotary 0.25 inch HEX adjustment	Adjusts the tunable cavity filter.	

3.2.2 CM-300 UT Rear Panel Connectors. The CM-300 UT rear panel connectors are shown in Figure 3-2 and explained in Table 3-2.

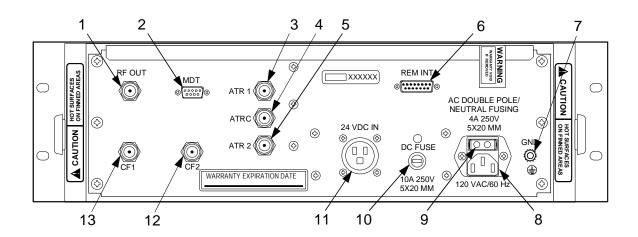


Figure 3-2. CM-300 UT Rear Panel Connectors

Table 3-2. CM-300 UT Rear Panel Connectors

Index			tai i anci connectors	
No.	Connector	Type	Function	
1	RF OUT	Type-N connector	Output connection to antenna, cavity filter or ATR.	
2	MDT	DB-9	RS232 interface to remote MDT device. See Section 3.2.5.2.	
3	ATR1	Type-N Connector	Normally Closed (NC) contact of the internal ATR.	
4	ATRC	Type-N Connector	Common contact of the internal ATR.	
5	ATR2	Type-N Connector	Normally Open (NO) contact of the internal ATR.	
6	REM INT	DB-15	Connection for remote interface. See Section 3.2.5.1.	
7	GND	Threaded post	Provides a ground connection to the transmitter chassis.	
8	120 VAC/60 Hz	3-conductor AC power connector	Connects transmitter to 120 VAC, 60 Hz source.	
9	AC DOUBLE POLE/NEUTRAL FUSING 4A 250V 5X20 MM SLOW	2 Fuses, 4 A 250 V	Provides overcurrent protection on 120 VAC line.	
10	DC FUSE 10A 250V 5X20 MM	Fuse, 10 A 250 V	Provides overcurrent protection on 24 VDC line.	
11	24 VDC	2-conductor DC power connector	Connects transmitter to 24 VDC source (pin 3 not connected).	
12	CF2	Type-N Connector	Output connection from the internal cavity filter.	
13	CF1	Type-N Connector	Input connection to the internal cavity filter.	

3.2.3 CM-350 UT Front Panel Controls, Indicators, and Connectors. The CM-350 UT front panel controls, indicators, and connectors are shown in Figure 3-3 and explained in Table 3-3.

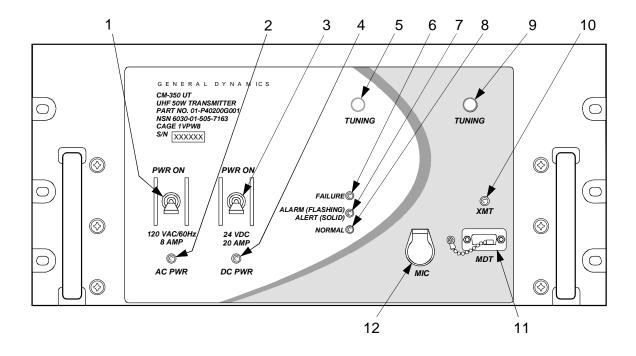


Figure 3-3. CM-350 UT Front Panel Controls, Indicators, and Connectors

Table 3-3. CM-350 UT Front Panel Controls, Indicators, and Connectors

Index	Controls, Indicators,		
No.	Connectors	Type	Function
1	PWR ON	Switch	Switches ON or OFF the 120 VAC power
	120 VAC/60 Hz		source.
	8 AMP		
2	AC PWR	Green LED	Lit when AC power is applied to the
		Indicator	transmitter.
3	PWR ON	Switch	Switches ON or OFF the 24 VDC power
	24 VDC		source.
	20 AMP		
4	DC PWR	Green LED	Lit when DC power is applied to the
		Indicator	transmitter.
5	TUNING (left)	Rotary 0.25	Adjusts the tunable cavity filter.
		inch HEX	
		adjustment	
6	FAILURE	Red LED	Indicates 3 types of failures. See Table
		Indicator	3-10.
7	ALARM (FLASHING)	Yellow LED	Indicates 9 types of alarms. See Table 3-11.
	ALERT (SOLID)	Indicator	Indicates 3 types of alerts. See Table 3-11.
8	NORMAL	Green LED	Lit when the transmitter is operating
		Indicator	correctly.
9	TUNING (right)	Rotary 0.25	Adjusts the tunable cavity filter.
		inch HEX	
		adjustment	
10	XMIT	Yellow LED	Lit when the transmitter is being keyed.
		Indicator	
11	MDT	DB-9	Local connector for MDT. See Section 3.2.5.2.
12	MIC	Phone Jack	Connection for Microphone for local audio
	:		input.

<u>3.2.4 CM-350 UT Rear Panel Connectors</u>.- The CM-350 UT rear panel connectors are shown in Figure 3-4 and explained in Table 3-4.

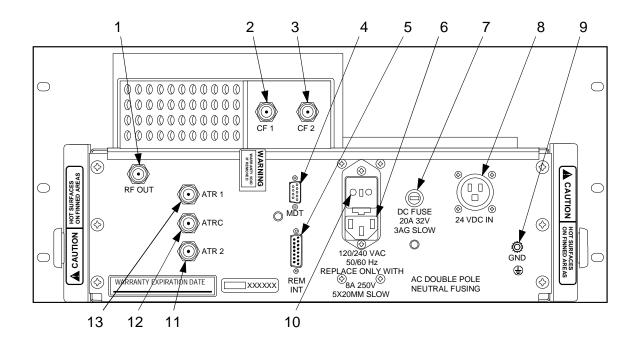


Figure 3-4. CM-350 UT Rear Panel Connectors

Table 3-4. CM-350 UT Rear Panel Connectors

Index			
No.	Connectors	Туре	Function
1	RF OUT	Type-N Connector	Output connection to Antenna, or ATR.
2	CF1	Type-N Connector	Input connection to cavity filter.
3	CF2	Type-N Connector	Output connection from cavity filter.
4	MDT	DB-9	Remote connector for MDT. See Section 3.2.5.2.
5	REM INT	DB-15	Connection for Remote Interface. See Section 3.2.5.1.
6	120/240 VAC 50/60 HZ	3 conductor AC power connector	Connects transmitter to 120/240 VAC, 50/60 Hz source. NOTE: Not recommended for 240
			VAC use.
7	DC FUSE 20A 32V 3 AG SLOW	Fuse, 20 A 32 V	Provides overcurrent protection on 24 VDC line.
8	24 VDC IN	2-conductor DC power connector	Connects transmitter to 24 VDC source (pin 3 not connected).
9	GND	Threaded post	Provides a ground connection to the transmitter chassis.
10	AC DOUBLE POLE/NEUTRAL FUSING 8A 250V	2 Fuses, 8 A 250 V	Provides overcurrent protection on 120/240 VAC line. NOTE: Not recommended for 240
	5X20 MM SLOW		VAC use.
11	ATR2	Type-N Connector	Normally Open (NO) contact of internal ATR.
12	ATRC	Type-N Connector	Common contact of internal ATR.
13	ATR1	Type-N Connector	Normally Closed (NC) contact of internal ATR.

- <u>3.2.5 Connector Interface Pin Outs.</u>- Tables 3-5 through 3-9 list the signal connections for the REM INT, MDT, 120 VAC/60 Hz, 24 VDC IN, and MIC connectors.
- <u>3.2.5.1 REM INT Connector Pin Outs.</u>- The REM INT connector of the radio is a 15-pin plug type connector (Figure 3-5). See Table 3-5 for REM INT connector pin assignments.

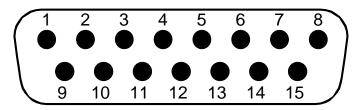


Figure 3-5. REM INT Connector, Pin Location

Table 3-5. REM INT Connector, Pin Assignments

Pin Number	Signal Name	Description	
1	ADDR_0	Address bit 0 for setting the radio unit number.	
2	ADDR_1	Address bit 1 for setting the radio unit number.	
3	GND	Ground.	
4	PTT_CONFIRM	Transmit Confirmation (Output). Remote feedback indication of transmitter status: Short Circuit = Transmitting (1 amp max) Open Circuit = Not Transmitting (< 80 VDC max)	
5	VOLTAGE_KEY	Voltage Controlled Transmitter Key (Input). Alternate input from remote user to key the transmitter: +6 VDC to +48 VDC - Keyed (0.5 mA max sink current applied for duration of key) Open - No Key	
6	PTT_CONF_RTN	Transmit Confirmation Return.	
7	REM_AUDIO_1	Voice Audio (input). Remote user voice input into a 600 ohm impedance.	
8	REM_AUDIO_2	Voice Audio Return.	
9	ADDR_2	Address bit 2 for setting the radio unit number.	
10	ADDR_3	Address bit 3 for setting the radio unit number.	
11	N/C	No Connection.	
12	GND	Ground.	
13	N/C	No Connection.	
14	CURRENT_KEY	Current Controlled Transmitter Key (Input). Remote user input to key the transmitter: Ground = Transmitter keyed (10 mA max) Open = Transmitter not keyed (<40 VDC)	
15	N/C	No Connection.	

<u>3.2.5.2 MDT Connector Pin Outs.</u>- The MDT connector of the radio is a 9-socket receptacle type connector (Figure 3-6). Table 3-6 describes the socket assignments for the MDT connector.

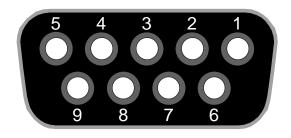


Figure 3-6. MDT Connector, Socket Location

Table 3-6. MDT Connectors, Socket Assignments

	Front			Rear
Socket Number	Signal Name	Description	Signal Name	Description
1	N/C	No Connection.	N/C	No Connection.
2	FR_TXD	Transmit Data from radio.	BACK_TXD	Transmit Data from radio.
3	FR_RXD	Receive Data to radio.	BACK_RXD	Receive Data to radio.
4	MDT_SENSE	Senses front (local) MDT connection and disables the rear (remote) MDT.	N/C	No Connection.
5	Ground	Ground	Ground	Ground.
6	N/C	No Connection.	N/C	No Connection.
7	N/C	No Connection.	N/C	No Connection.
8	N/C	No Connection.	N/C	No Connection.
9	N/C	No Connection.	N/C	No Connection.

<u>3.2.5.3 120 VAC/60 Hz Connector Pin Outs.</u> The pin assignments of the 120 VAC/60 Hz Connector (Figure 3-7) are described in Table 3-7.

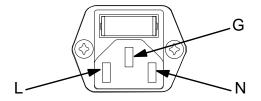


Figure 3-7. 120 VAC/60 Hz Connector, Pin Location

Table 3-7. 120 VAC/60 Hz Connector, Pin Assignments

Pin Number	Signal
G	AC Ground.
N	AC Neutral.
L	AC Line.

<u>3.2.5.4 24 VDC IN Connector Pin Outs.</u>- Table 3-8 describes the pin assignments for the 24 VDC IN Connector.

Table 3-8. 24 VDC IN Connector, Pin Assignments

Pin Number	Signal
1	+24 VDC Input.
2	Ground.
3	Not connected.

<u>3.2.5.5 MIC Connector Pin Outs.</u>- Table 3-9 describes the pin assignments for the MIC Connector.

Table 3-9. MIC Connector, Pin Assignments

Pin Number	Signal
1 (Ring)	Microphone Audio Input.
2 (Sleeve)	Ground.
3 (Tip)	PTT (Push To Talk).

<u>3.3 OPERATION OF FRONT PANEL INDICATORS AND MICROPHONE</u>.- This paragraph describes the operation of the NORMAL indicator, FAILURE indicator, ALARM /ALERT indicator, and Microphone.

The significance of a NORMAL, ALERT, ALARM, or FAILURE condition is as follows:

- NORMAL Normal condition, transmitter operational.
- ALERT Some performance parameters degraded, transmitter still operational.
- ALARM Performance severely degraded, transmitter operational status questionable.
- FAILURE Transmitter not operational, requires immediate attention
- <u>3.3.1 NORMAL Indicator.</u>- The NORMAL indicator is a green LED and, when lit, indicates that the radio is operating normally.
- <u>3.3.2 FAILURE Indicator</u>.- The FAILURE indicator is a red LED and, when lit, indicates three types of failures for the CM-300 UT and the CM-350 UT (Table 3-10). These failure indicators are also monitored at the MDT.

Table 3-10. Failure Indicated by FAILURE LED

Failure	Description
ALC	This fault indicates a problem with the internal ALC control in the transmitter. This fault will prevent the transmitter from transmitting.
PTT	This fault indicates a problem with the internal power amplifiers not being able to produce a RF output in the transmit mode. The transmitter is prevented from transmitting in this condition until the problem is corrected.
Synth1 frequency	This fault indicates that the internal Synthesizer has not locked on frequency. The transmitter will be prevented from transmitting because the frequency may not be correct. It may be possible to correct this condition by cycling the power to the unit.

3.3.3 ALARM/ALERT Indicator.- The ALARM/ALERT indicator is a yellow LED and, when it's flashing, it indicates 9 types of Alarms; when lit but not flashing, indicates 3 types of Alerts. Table 3-11, applies to both the CM-300 UT and the CM-350 UT, except when noted. These Alarm/Alert indicators are also monitored at the MDT. See Section 7.3 for fault isolation procedures.

Table 3-11. Faults Indicated by ALARM/ALERT LED

Alarm/ Alert	Fault	Description
Alarm	+12 V	If the Microprocessor detects an out of tolerance condition on the internal 12 VDC power supply, the transmitter will continue to operate, but a Voltage Error message is displayed.
Alarm	+26 V	If the Microprocessor detects an out of tolerance condition on the internal +26 VDC power supply, the transmitter will continue to operate, but a Voltage Error message is displayed
Alarm	+5 V	If the Microprocessor detects an out of tolerance condition on the internal +5 VDC power supply, the transmitter will continue to operate, but a Voltage Error message is displayed.
Alarm	-12 V	If the Microprocessor detects an out of tolerance condition on the internal -12 VDC power supply, the transmitter will continue to operate, but a Voltage Error message is displayed.
Alarm	-8 V	If the Microprocessor detects an out of tolerance condition on the internal -8 VDC power supply, the transmitter will continue to operate, but a Voltage Error message is displayed.
Alarm	ATR	This alarm indicates that the transmitter has sensed that the Antenna Transfer Relay is not in the proper commanded position. The transmitter will continue to operate with this alarm.
Alarm	Over temp (Exciter)	If the ambient air temperature surrounding the transmitter rises above 50°C, the transmitter will continue to operate but the power out will be reduced by one half, and an Overtemp Alarm message will be generated. If the transmitter cools to within the normal limits, the alarm message will reset and the transmitter will return to full power.
Alarm	Over temp (PA) (CM-350 UT only)	If the ambient air temperature surrounding the transmitter rises above 50°C, the transmitter will continue to operate but the power out will be reduced by one half, and an Overtemp Alarm message will be generated. If the transmitter cools to within the normal limits, the alarm message will reset and the transmitter will return to full power.

Table 3-11. Faults Indicated by ALARM/ALERT LED (Contd)

Alarm/ Alert	Fault	Description
Alarm	Overmodu- lation	The Microprocessor will set the Overmodulation Alarm if it detects an overmodulation condition while in the transmit mode (PTT button is pressed). This alarm will be reset when the condition is corrected while in the transmit mode, or when the transmitter stops transmitting (PTT button is released).
Alert	Elapsed Time	This alert will occur when the internal elapsed time clock has failed to update. This alert is a "report" only and will not effect normal operation of the transmitter.
Alert	Low Output Power	A Low Output Power Alert will be set when the sensed RF output level has not exceeded an expected minimum threshold while in the transmit mode (PTT button is pressed). This alert will be reset when the transmitter stops transmitting (PTT button is released).
Alert	Transmitter Timeout	This alert condition is set when the Transmitter Timeout Limit has been exceeded and the transmitter stops transmitting. This alert will clear when the transmitter stops transmitting (PTT button is released).

<u>3.3.4 Microphone</u>.- The microphone is connected to the MIC connector on the transmitter front panel. It facilitates audio inputs to the radio.

Key the transmitter by pressing the Push To Talk (PTT) button on the microphone. In a transceiver configuration where a common antenna is used (see Section 10.6.5.4.11), pressing the PTT button sets the ATR of the transmitter to the transmit mode. Releasing the PTT button returns the ATR of the transmitter to the receive mode.

- <u>3.4 MDT OPERATION.</u> The MDT is used for the initial set up and configuration of the system and subsequently for monitoring and control of the equipment and its functions. The transmitter is capable of responding to configuration commands and status inquires via the MDT local (front) and remote (rear) connectors. The MDT uses the UHF MDT software which provides the Graphic User Interface (see Section 10).
- <u>3.4.1 Communication Standards</u>.- A standard 9-pin, RS-232, male to female, serial cable may be used for this application. The radio only uses pins 2, 3, 4, and 5 of the cable. The rest of the pins are not used. See Table 3-12.

For a computer serial port with a DB-9 connector, pin 2 is the receive line, pin 3 is the transmit line, pin 4 is the terminal-ready line, and pin 5 is ground. On the radio MDT connector (Figure 3-4), pin 2 is the transmit line, while pin 3 is the receive line, pin 4 is the MDT_SENSE line, and pin 5 is ground.

The baud rate is 9600 with 8 data bits, 1 start bit, 1 stop bit, and with no parity.

Table 3-12. RS-232 and MDT Connector, Pin Assignments

	RS-232 Connector		CM-300 UT/CM-350 UT MDT Connector	
Pin Number	Signal Name	Signal Description	Signal Names	Signal Description
1	DCD	Data Carrier Detect.	N/C	N/C
2	RxData	Received Data.	TxD	Transmitted Data.
3	TxData	Transmitted Data.	RxD	Received Data.
4	DTR	Data Terminal Ready.	Front Panel-MDT_SENSE. Rear Panel-N/C.	Disables rear MDT. N/C
5	GND	Signal Ground.	GND	GND
6	DSR	Data Set Ready.	N/C	N/C
7	RTS	Request To Send.	N/C	N/C
8	CTS	Clear To Send.	N/C	N/C
9	RI	Ring Indicator.	N/C	N/C

3.4.2 Messages from the Radio to the MDT. When requested by the MDT, the radio will send status messages when a monitored parameter transitions into alarm state, into alert state, back into normal state, or fails. The status of the FAILURE and ALARM/ALERT indicators (see

Tables 3-10 and 3-11) is monitored through the MDT. All possible Alarm/Alert/Fail parameters are displayed and can be sorted by clicking on the column heading (see Section 10.6.5.4.4).

The significance of a NORMAL, ALERT, ALARM, or FAILURE condition is as follows:

NORMAL - Normal condition, transmitter operational.

ALERT - Some performance parameters degraded, transmitter still operational.

ALARM - Performance severely degraded, transmitter operational status questionable.

FAILURE - Transmitter not operational, requires immediate attention.

3.3 TRANSMITTER START-UP AND OPERATION. The transmitter may be operated continuously from an AC or a DC power source alone, or both may be connected. If both are connected, the transmitter will operate off of the AC power source, and the DC power source (i.e. battery) will provide emergency power in the event of an AC power failure. Switchover from AC to DC is done automatically internal to the transmitter and is transparent to the operator.

WARNING

Electromagnetic radiation from the antenna can damage eyes and other body tissue when unit is transmitting. While unit is transmitting, remain at least 24 inches from transmitting antenna.

NOTE

When the DC PWR switch is in the ON position, the transmitter will draw a small amount of current from the DC power source to light the front panel DC PWR LED. Because of this, if a battery is connected to the DC power input, it may eventually be drained unless it is connected to a charging circuit.

The transmitter's operating parameters are stored in non-volatile memory. These parameters are stored even when the power is turned off and prime power is removed. Parameters stored in non-volatile memory are:

- Frequency
- Operating Time
- Event Log
- Power Level
- Mod Index
- Limiter Level
- Reference Frequency
- Tx Time Out
- ATR Relay
- RF Tuning Mode
- PTT
- Software Version
- Serial Number
- Elapsed Time
- Total PTTs

When the transmitter is turned on, the transmitter will operate using the configuration and operating parameters (frequency, etc.) stored in the non-volatile memory. Once the transmitter is turned on, these operating parameters can be changed (see Section 10.6.5.4). The new parameters will be automatically stored in memory.

To turn the transmitter on proceed as follows:

- 1. Make sure that the transmitter is connected for operation according to the cabling instructions in section 9.3.4.
- 2. If both AC and DC power have been applied to the transmitter, turn the transmitter on by setting both PWR ON switches to on (up position). Ensure that the power indicator LEDs on the front panel are lit.
- 3. If only one power source has been applied to the transmitter, turn the transmitter on by setting the appropriate PWR ON switches to on (up position). Ensure that the appropriate power indicator LED is lit.
- 4. Allow a 30 second warm-up. The transmitter is designed to meet all operating specifications after the warm-up period.
- 5. THE TRANSMITTER WILL OPERATE USING THE PARAMETERS STORED IN MEMORY. IF THE TRANSMITTER HAS NOT BEEN TUNED, OR THE OPERATOR DESIRES TO CHANGE THE TRANSMITTER'S CONFIGURATION OR OPERATING PARAMETERS, PERFORM THE TUNING PROCEDURES OUTLINED IN SECTION 9.6 (FOR CM-300 UT) OR 9.7 (FOR CM-350 UT).
- 3.4 EQUIPMENT SHUTDOWN.- For an orderly equipment shutdown, proceed as follows:
 - 1. If you are in the process of editing radio parameters using the MDT, make sure you apply all required changes (see Section 10.6.5.2.2) before turning the radio off. If not, changes will be lost.

WARNING

High voltage and current are present at the AC and DC power connectors at the rear of the unit. Remove all power before proceeding with uninstallation procedures. Failure to do so, may result in serious bodily injury.

WARNING

Use the front panel handles when handling the transmitter. Avoid touching the heat sinks, on either side of the transmitter. The heat sinks may be hot enough to cause serious skin burns.

WARNING

If the ATR Relay is set from the MDT, it is imperative that it is returned to the Normal setting before disconnecting the MDT. If not, radio two-way communications will be disabled which may result in very serious consequences.

When the MDT reestablishes a connection, it can not determine if the ATR Relay was asserted by the MDT in a previous session.

WARNING

If the PTT is set to On from the MDT, it is imperative that it is returned to the Off setting before disconnecting the MDT. If not, radio two-way communications will be disabled which may result in very serious consequences.

When the MDT reestablishes a connection, it can not determine if the PTT was asserted by the MDT in a previous session.

- 2. From the MDT, return the ATR Relay to the Normal setting (see Section 10.6.5.4.11).
- 3. From the MDT, return the Remote PTT to the Off setting (see Section 10.6.5.4.12).
- 4. Exit the UHF MDT Software and disconnect the MDT.
- 5. Turn the transmitter off by setting both PWR ON switches off (down). Ensure that both power indicator LEDs on the transmitter front panel are off.

NOTE

The CM-350 UT power LEDs take approximately 10 seconds to bleed off.

<u>3.7 EMERGENCY OPERATION</u>.- Emergency operation is limited to the case where AC power failure occurs.

Ensure that a 24-volt DC power source has been connected to the 24 DC IN power input of the transmitter, according to the cabling instructions in section 9.3.4 and that the DC PWR ON switch is in the on position (up). The transmitter will automatically switch over to DC power when primary AC power is lost.

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SECTION 4 STANDARDS AND TOLERANCES

Refer to the UHF CM-300 Series Maintenance Handbook, for guidance and prescribed technical standards and tolerances, and procedures applicable to the maintenance and inspection of the CM-300 equipment.

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SECTION 5 PERIODIC MAINTENANCE

- <u>5.1 INTRODUCTION</u>.- This section lists the maintenance activities that need to be performed on the UHF transmitter on a regular basis.
- <u>5.2 PERFORMANCE CHECKS</u>.- Table 5-1 lists regularly required performance checks necessary to ensure the transmitter is operating within established tolerances and limits. Cross reference is made in the table to the appropriate maintenance procedure in Section 6 and to the applicable Standards and Tolerances in Section 4.

Table 5-1. CM-300 UT/CM-350 UT Periodic Performance Checks

		Reference Paragraph	
	Performance Check	Standards and	Maintenance
	and Schedule	Tolerances	Procedure
a.	Reference Frequency Check	Section 4	Para. 6.2
b.	RF Power Output Check	Section 4	Para. 6.3
c.	Modulation Level Check	Section 4	Para. 6.4
d.	VSWR at Transmitter Output Check	Section 4	Para. 6.5
e.	ATR Switch Check	Section 4	Para. 6.6

- <u>5.3 OTHER MAINTENANCE TASKS</u>.- The following procedures may be performed on an asrequired basis.
- <u>5.3.1 Tuning and Alignment</u>.- Tuning shall be accomplished on an as-required basis. Refer to Section 9, paragraphs 9.6 and 9.7.
- <u>5.3.2 Exterior Cleaning</u>.- Perform cleaning tasks on an as-required basis to prevent deterioration of the equipment. Refer to Section 6.7.1.

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SECTION 6

MAINTENANCE PROCEDURES

<u>6.1 INTRODUCTION</u> - This section contains the procedures used to perform the periodic performance checks listed in Section 5. Each procedure lists the test equipment required, shows a block diagram of the test set-up, and gives the step-by-step instructions. Measured results should meet the Standards and Tolerances of Section 4. Results should be recorded on the appropriate form each time a check is performed so that a record is kept of the transmitter performance history. The procedures in this section should be performed in sequential order, starting at paragraph 6.2.

In order to perform the checks, the operator should be thoroughly familiar with the operation of the front panel controls and indicators, MDT operation, and UHF MDT software. Refer to Sections 3 and 10.

WARNING

Do not disconnect the coaxial cable from the transmitter antenna port (RF OUT) without first disconnecting the Remote cable from the REM INT connector. This will insure that the transmitter will not be remotely keyed with the load disconnected. While the transmitter is protected from high load VSWR in this condition, it is possible for personnel to sustain RF burns if handling open cable ends with the transmitter keyed.

NOTE

In the CM-300 UT, set the transmitter timeout to CONT (see Section 10.6.5.4.10) or the transmitter may time out during the procedure.

In the CM-350 UT, set the transmitter timeout to the maximum setting (60 secs) (see Section 10.6.5.4.10). Rekey the transmitter if it times out during the procedure (see Section 10.6.5.4.12).

Upon completion of check procedures, restore transmitter timeout to original setting (see Section 10.6.5.4.10).

NOTE

The technician should take appropriate measures to ensure that air traffic will not be impacted while performing the procedures outlined in this section. This may require the technician to take the affiliated transmitter or channel out of service.

<u>6.2 OPERATING FREQUENCY CHECK</u> - The purpose of this procedure is to determine if transmitter frequency is within specified limits. The measurement is made at the transmitter ATRC port.

6.2.1 Test Equipment

- HP 5384A Frequency Counter, or equivalent
- Bird 4230-059 Directional Coupler (RF Body), or equivalent
- JWF Model 50T-032-1:1 Dummy Load, or equivalent
- MDT

6.2.2 Procedure

- 1. Connect the frequency counter to the meter out of the RF body associated with the transmitter ATRC connector, refer to figure 6-1.
 - 2. Connect the output of the RF Body to the Dummy Load, refer to figure 6-1.

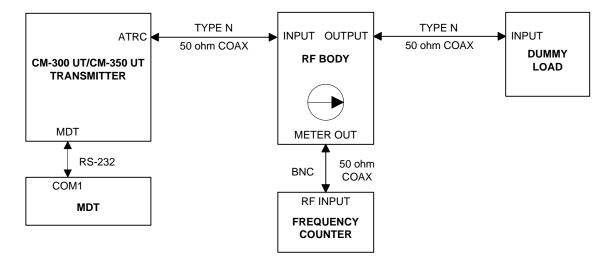


FIGURE 6-1. TEST SETUP FOR REFERENCE MONITOR FREQUENCY CHECK

3. From the CM-300 UT Detail Front Panel window, click on Remote PTT button, refer to figure 6-2.

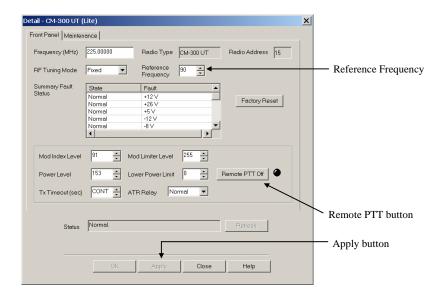


FIGURE 6-2. CM-300 UT DETAIL WINDOW – FREQUENCY CHECK

- 4. Measure and record transmitter frequency on the appropriate form. If the tolerance of the frequency does not meet the requirements, adjust the frequency by performing step 5.
 - 5. From the CM-300 UT Detail Front Panel window (refer to figure 6-2):
- a. Select the Reference Frequency down or up arrow to change the transmitter frequency.
 - b. Click on Apply to apply the changes.
 - c. Measure and record the new transmitter frequency on the appropriate form.
- 6. Unkey the transmitter by selecting the Remote PTT button. Re-connect the radio for normal operation unless other maintenance checks are needed.

<u>6.3 RF POWER OUTPUT CHECK</u> - The purpose of this procedure is to verify the transmitter power output level.

6.3.1 Test Equipment

- MDT
- Wattmeter with RF Sampler
- Bird 4230-059 Directional Coupler (RF Body), or equivalent
- JWF Model 50T-032-1:1 Dummy Load, or equivalent

6.3.2 Procedure

- 1. Connect the RF Sampler connector of the Wattmeter to the meter out of the RF body associated with the transmitter ATRC connector, refer to figure 6-3.
 - 2. Connect the output of the RF Body to the Dummy Load, refer to figure 6-3.

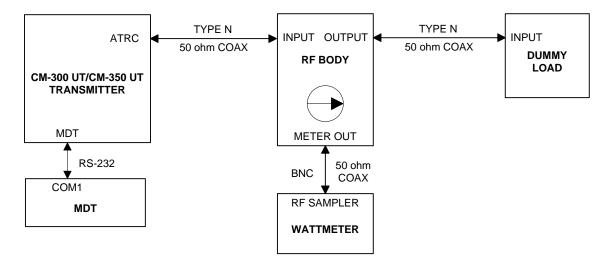


FIGURE 6-3. TEST SETUP FOR RF POWER CHECK

3. From CM-300 UT Detail Front Panel window, click the Remote PTT button, refer to figure 6-4.

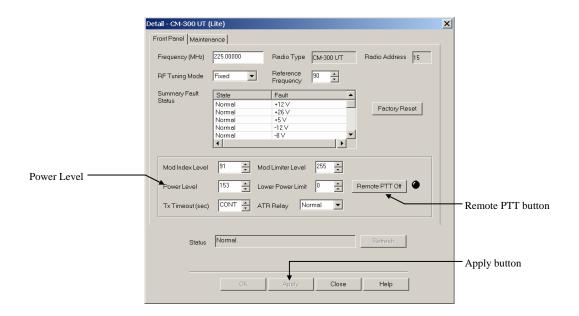


FIGURE 6-4. CM-300 UT DETAIL FRONT PANEL WINDOW – RF POWER CHECK

- 4. Measure and record the transmitter power out on the appropriate form. If the power out does not meet the requirement adjust the power out by performing step 5.
 - 5. From the CM-300 UT Detail Front Panel window (refer to figure 6-4):
- a. Increase or decrease the power setting by clicking on the up or down arrow to the right side of the Power Level.
 - b. Click the Apply button to apply the selected power setting.
- c. Measure and record the new transmitter power out on the appropriate form, as required.
- 6. Unkey the transmitter by selecting the Remote PTT button. Re-connect the radio for normal operation unless other maintenance checks are needed.

<u>6.4 VSWR AT TRANSMITTER OUTPUT</u> - This procedure is to verify that the output VSWR does not exceed specified limits. For this test the transmitter should be connected to the system antenna that it normally drives.

6.4.1 Test Equipment

- MDT
- Wattmeter with RF Sampler
- Bird 4230-059 Directional Coupler (RF Body), or equivalent

6.4.2 Procedure

- 1. Connect the input of the RF Body to the transmitter ATRC connector, refer to figure 6-5.
- 2. Connect the output of the RF Body to the antenna, refer to figure 6-5.
- 3. Connect the RF Sampler connector of the Wattmeter to the meter out of the RF Body associated with the transmitter ATRC output, refer to figure 6-5.

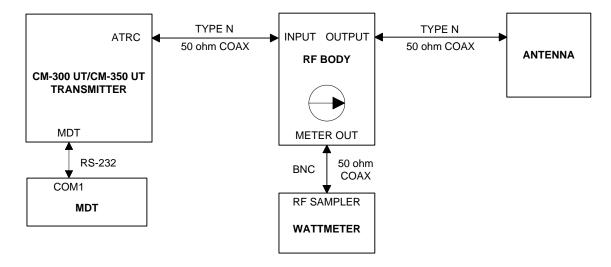


FIGURE 6-5. TEST SETUP FOR VSWR CHECK

- 4. Set the RF Body to measure forward power.
- 5. From CM-300 UT Detail Front Panel window, key the radio by clicking the Remote PTT button, refer to figure 6-6.

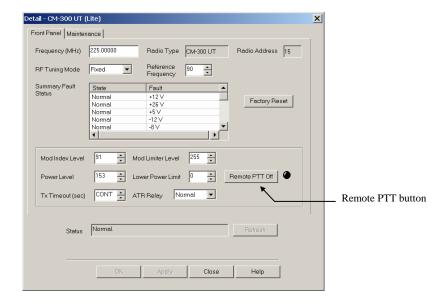


FIGURE 6-6. CM-300 UT DETAIL FRONT PANEL WINDOW - VSWR

- 6. Note the forward power level on the Wattmeter.
- 7. From CM-300 UT Detail Front Panel window, unkey the transmitter (click the Remote PTT button).
 - 8. Set the RF Body to measure reverse power.
- 9. From CM-300 UT Detail Front Panel window, key the transmitter (click the Remote PTT button).
 - 10. Note the reverse power level on the Wattmeter.
 - 11. Unkey the transmitter (Click the Remote PTT button).
- 12. Calculate the percent-reflected power from the forward and reverse power reading using the following formula:

Percent Reflected Power = (Reflected Power ÷ Forward Power) x 100

- 13. Determine the VSWR using figures 6-7 and 6-8. Locate the percent reflected power along the vertical axis; move right to find the point where this intersects the curve on the graph, and then drop down the horizontal axis for the VSWR reading.
 - 14. Record the VSWR on the appropriate form, as required.
- 15. Re-connect the radio for normal operation unless other maintenance checks are needed.

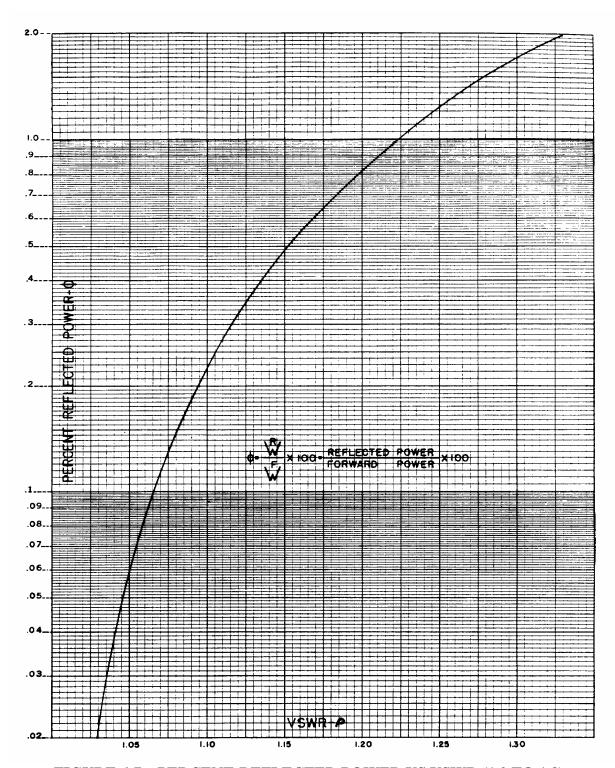


FIGURE 6-7. PERCENT-REFLECTED POWER VS VSWR (1.0 TO 1.3)

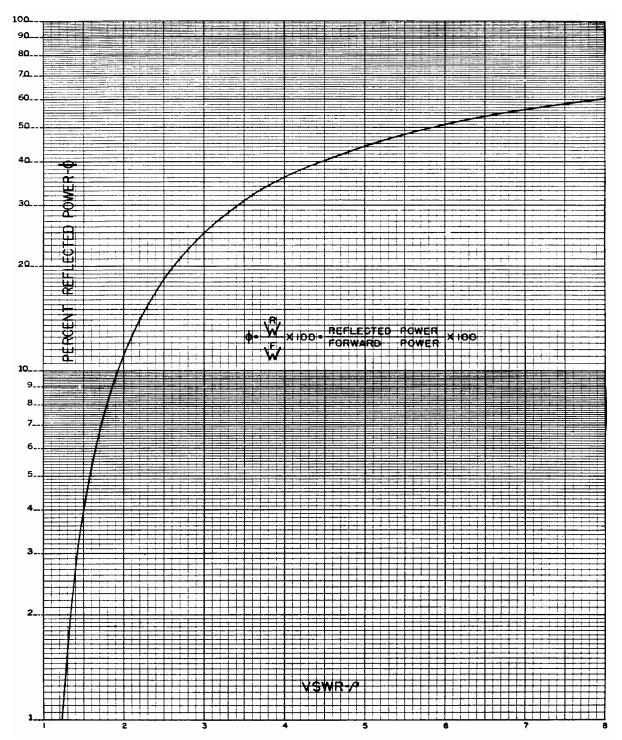


FIGURE 6-8. PERCENT-REFLECTED POWER VS VSWR (1.0 TO 8.0)

<u>6.5 MODULATION LEVEL</u> - The purpose of this procedure is to measure percent modulation.

6.5.1 Test Equipment

- MDT
- Bird 4230-059 Directional Coupler (RF Body), or equivalent
- 400 MHz Oscilloscope
- JWF Model 50T-032-1:1 Dummy Load, or equivalent

6.5.2 Procedure

- 1. Connect the oscilloscope input to the meter out connector of the RF Body, refer to figure 16.
 - 2. Connect the output of the RF Body to the Dummy Load, refer to figure 6-9.
 - 3. Set the oscilloscope to measure modulation for the frequency being used.

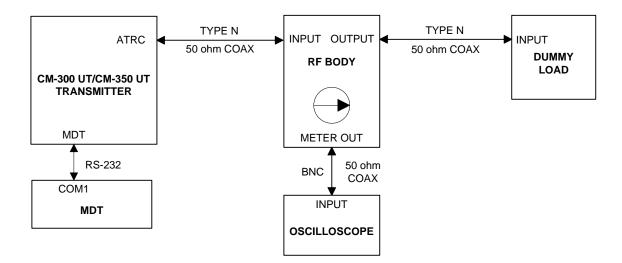


FIGURE 6-9. TEST SETUP FOR PERCENT MODULATION CHECK

- 4. Request test count from air traffic control. Observe Oscilloscope for voice peaks not to exceed the standards and tolerances.
- 5. Measure the modulation using the oscilloscope. Record the value on the appropriate form, as required.
- 6. If the percent modulation does not meet the requirement adjust the percent modulation by performing step 7.
 - 7. Request a test count from Air Traffic.
- a. While observing the oscilloscope, adjust the Mod Index Level to provide a percent modulation on voice peaks that meet the standards and tolerance. Insure to click the Apply button to apply the new setting, refer to figure 6-10.
- b. Measure and record the percent modulation on the appropriate form, as required.

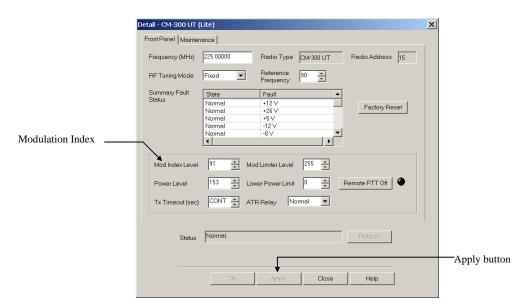


FIGURE 6-10. PERCENT MODULATION CHECK

- 8. Re-connect the radio for normal operation unless other maintenance checks are needed.
- <u>6.6 ATR SWITCH CHECK</u> This procedure is to verify that the insertion loss through the transmitters internal ATR switch does not exceed specified limits.

NOTE

This check requires that the transmitter and associated receiver (transceiver configuration) be removed from service. If in a transmitter/transmitter configuration, take only the transmitter to be checked out of service and use the CF2 port in place of the ATRC.

6.6.1 Test Equipment

- Agilent E4434B Signal Generator, or equivalent
- Agilent 8901 Modulation Analyzer, or equivalent
- MDT

6.6.2 Procedure

- 1. Set front panel switches on Signal Generator to the following:
 - a. Output Level = -20 dBm
 - b. Signal Generator frequency to 300 MHz
 - c. AM = OFF
 - d. FM = OFF
 - e. RF = ON

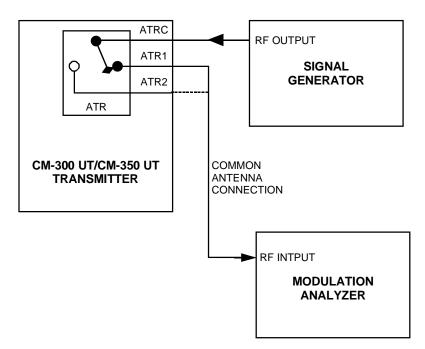


Figure 6-11. ATR Switch Check

- 2. Connect the Signal Generator to the Modulation Analyzer using the same cables that will be used when setting up Figure 6-11. This will calibrate out the loss in the cables. Using the Modulation Analyzer, measure and record the RF level in dBm.
 - 3. Connect the equipment as shown in Figure 6-11.
 - 4. Using the MDT, set the ATR relay to ATR1 (see Section 10.6.5.4.11).

- 5. Using the Modulation Analyzer, measure and record the RF level in dBm.
- 6. Calculate the difference in the RF Level between step 2 and step 5. This is the insertion loss from ATRC to ATR1. The insertion loss should be less the 1 dB.
- 7. Remove the cable that is connected to ATR1 and connect it to ATR2. The Modulation Analyzer should now be connected to ATR2.
 - 8. Using the MDT, set the ATR relay to ATR2 (see Section 10.6.5.4.11).
 - 9. Using the Modulation Analyzer, measure and record the RF level in dBm.
- 10. Calculate the difference in the RF Level between step 2 and step 9. This is the insertion loss from ATRC to ATR2. The insertion loss should be less the 1 dB.
 - 11. Using the MDT, set the ATR relay to Normal (see Section 10.6.5.4.11).

WARNING

It is imperative that the ATR Relay is returned to the Normal setting before disconnecting the MDT. If not, radio two-way communications will be disabled which may result in very serious consequences.

<u>6.7 OTHER MAINTENANCE PROCEDURES</u> - These procedures are mainly periodic cleaning tasks to prevent deterioration of the equipment.

6.7.1 Exterior Cleaning - To clean the unit's exterior, use a clean lint-free cloth moistened in a solution of mild household detergent and water. Follow this with a clean lint-free cloth moistened in clean water, then wipe dry. Never use harsh detergents, chemical cleaning agents, abrasive compounds, or bristle brushes to clean the unit for these may permanently mar the surface.

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General Dynamics Decision Systems CM-300 UT/CM-350 UT

SECTION 7 CORRECTIVE MAINTENANCE

<u>7.1 INTRODUCTION</u>.- This section provides fault isolation procedures and instructions for the removal/replacement of AC and DC fuses and removal/replacement of the transmitter from the rack.

In order to perform these procedures, the maintainer should be thoroughly familiar with the operation of the front panel controls and indicators, MDT operation, and MDT software (GUI). Operation of the front panel controls and indicators is provided in Section 3. Operation of the MDT software (GUI) is provided in Section 10.

<u>7.2 WARRANTY REPAIR.</u>- The transmitter has been purchased with a warranty. The warranty expiration date is listed on a label on the rear of the transmitter. If a transmitter failure occurs while under warranty, follow the instructions in Appendix A for warranty service.

NOTE

The transmitter is the Lowest Replaceable Unit (LRU). Removing the transmitter cover will void the warranty resulting in repair delays and additional expense.

<u>7.3 FAULT ISOLATION.</u>- This paragraph provides fault isolation procedures down to the LRU. The fault isolation procedure is in tabular format. The first column identifies the failure, the second column presents the possible cause(s) of the failure, and the third column suggests a course of action. See Tables 7-1 and 7-2.

When fault isolating Alert, Alarm, or Failure indications, keep in mind that some of these error messages are "report" only messages and may or may not indicate a failure of the transmitter. Refer to Table 7-2.

The significance of a NORMAL, ALERT, ALARM, or FAILURE condition is as follows:

- NORMAL Normal condition, transmitter operational.
- ALERT Some performance parameters degraded, transmitter still operational.
- ALARM Performance severely degraded, transmitter operational status questionable.
- FAILURE transmitter not operational, requires immediate attention.

Table 7-1. Fault Isolation

Problem	Possible Cause(s)	Suggested Course of Action
AC Power LED not lit.	1. AC PWR ON switch not on.	Ensure the AC PWR ON switch is in the up position.
	2. AC power cord connections incorrect or missing.	2. Ensure the AC power cord is connected to the back of the radio and to an AC power source. Also make sure the power source is providing the correct power level.
	3. AC fuses faulty.	3. Check the AC fuses and replace if required (see Section 7.4.1).
	4. AC PWR LED faulty.	4. Check the AC PWR LED status. If the radio is functional (with DC PWR off) but the AC Power LED is not lit, then the LED may be faulty. Replace radio (see Sections 7.4.3 and 7.4.4).
	5. Radio power supply malfunction.	5. Replace radio (see Sections 7.4.3 and 7.4.4).
DC Power LED not lit.	1. DC PWR ON switch not on.	1. Ensure the DC PWR ON switch is in the up position.
	2. DC power cord connections incorrect or missing.	2. Ensure the DC power cord is connected to the back of the radio and to a DC power source. Also make sure the power source is providing the correct power level.
	3. DC fuse faulty.	3. Check the DC fuse and replace if required (see Section 7.4.2).
	4. DC PWR LED faulty.	4. Check the DC PWR LED status. If the radio is functional (with AC PWR off) but the DC Power LED is not lit, then the LED may be faulty. Replace radio (see Sections 7.4.3 and 7.4.4).
	5. Radio power supply malfunction.	5. Replace radio (see Sections 7.4.3 and 7.4.4).

Table 7-1. Fault Isolation (Contd)

Problem	Possible Cause(s)	Suggested Course of Action
Radio appears to have problems transmitting.	Incorrect or missing connections.	1. Ensure all cables are connected correctly.
	2. Intermittent fault (not repetitive on event log after power cycle).	2. Check event log as described in Section 10.6.5.6.2. Cycle power to the radio. Turning the power off and then back on may clear the fault.
	3. Modulation Percentage is too low. Mod Index Level and/or Mod Limiter Level set improperly for particular power level or frequency.	3. Set Mod Limiter Level and Mod Index Level (see Sections 9.6.7 and 9.7.7). Note that operating frequency and output power level have to be adjusted first.
	4. Audio volume not set high enough on the receiver.	4. Ensure the receiver remote audio volume level is set high enough to hear by changing audio level (see Sections 10.6.5.4.7 of TI 6620.8). Ensure the local audio volume is set high enough to hear by adjusting the front panel volume knob.
	5. Radio not on the right operating frequency.	5. Ensure the radio is set to the correct frequency (see Sections 9.6.2 and 9.7.2).
	6. Distortion is too high (or recovered audio appears clipped). Overmodulation	6. Check that the radio is not overmodulating by following the Setting Modulation Percentage procedure (see Sections 9.6.7 and 9.7.7).
	7. Power out is too low. Cavity filter not set correctly.	7. If using the cavity filter then ensure the radio is in the fixed mode (see Section 10.6.5.4.2). Also ensure that the cavity filter is tuned to the proper frequency (see Sections 9.6.5 and 9.7.5).
	8. Reference frequency incorrect.	8. Ensure the reference frequency is within tolerance and adjust as required (see Sections 9.6.3 and 9.7.3).

Table 7-1. Fault Isolation (Contd)

Problem	Possible Cause(s)	Suggested Course of Action
	9. Failure locks out the PTT capability.	9. Verify that a Failure is not displayed on front panel and/or event log (see Section 10.6.5.6.3). If so, troubleshoot the displayed Failure.
	10. Fault indications (Alert/Alarm/Failure)	10. Check the fault status per paragraph 10.6.5.4.4. Fault isolates each Alert/Alarm/Failure indication as described in Table 7-2.
	11. Persistent fault (repetitive on event log after power cycle).	11. Check event log as described in Section 10.6.5.6.3. If the condition persists, replace the radio (see Sections 7.4.3 and 7.4.4).

Table 7-2. Fault Isolation of Alarm/Alert/Failure Indications

Problem	Possible Cause(s)	Suggested Course of Action	
+12 V Alarm	If the microprocessor detects an out		
+26 V Alarm	of tolerance condition on one of the internal DC power supply voltages,		
+5 V Alarm	the transmitter will continue to		
-12 V Alarm	operate, but a voltage error message is displayed.		
-8 V Alarm	as easpley vol.		
	Intermittent fault (not repetitive on event log after power cycle).	1. Check event log as described in Section 10.6.5.6.3. Cycle power to the radio. Turning the power off and then back on may clear the fault.	
	2. The radio power supply is not providing the correct power level.	2. Ensure that the AC or DC power supply is providing the correct power level.	
	3. Persistent fault (repetitive on event log after power cycle).	3. Check event log as described in Section 10.6.5.6.3. If the condition persists, replace the radio (see Sections 7.4.3 and 7.4.4).	
-8 V, -12 V Alarms	Overmodulation. If the radio is overmodulated, it may induce DC voltage alarms.	Remedy the Overmodulation Alarms and the DC voltage statuses should return to normal.	
		See Overmodulation Alarm below.	
ATR Alarm	This alarm indicates that the transmitter has sensed that the Antenna Transfer Relay (ATR) is not in the proper commanded position.		
	1. Intermittent fault (not repetitive on event log after power cycle).	1. Check event log as described in Section 10.6.5.6.3. Cycle power to the radio. Turning the power off and then back on may clear the fault.	

Table 7-2. Fault Isolation of Alarm/Alert/Failure Indications (Contd)

Problem	Possible Cause(s)	Suggested Course of Action	
	2. Reset the ATR to the desired position using the MDT.	2. Use the Set the ATR Relay procedure to set the desired position (see Section 10.6.5.4.11).	
	3. The ATR is not responding.	3. If the condition persists (check event log as described in Section 10.6.5.6.3), replace the radio (see Sections 7.4.3 and 7.4.4).	
Over temp (Exciter) Alarm	If the ambient air temperature surrounding the transmitter rises above a factory set threshold, the transmitter will continue to operate but the power out will be reduced by one half, and an Overtemp Alarm message will be generated.	If the transmitter cools to within the normal limits, the alarm message will reset and the transmitter will return to full power.	
Over temp (PA) (CM-350 UT only) Alarm	If the ambient air temperature surrounding the transmitter rises above a factory set threshold, the transmitter will continue to operate but the power out will be reduced by one half, and an Overtemp Alarm message will be generated.	If the transmitter cools to within the normal limits, the alarm message will reset and the transmitter will return to full power.	
Overmodulation Alarm	Mod Index Level and/or Mod Limiter Level set improperly for particular out power level or frequency.		
	1. Intermittent fault (not repetitive on event log).	1. Check event log as described in Section 10.6.5.6.3. Cycle power to the radio. Turning the power off and then back on may clear the fault.	
	2. Mod Index Level and/or Mod Limiter Level set improperly for particular out power level or frequency	2. Set Mod Limiter Level and Mod Index Level (see Sections 9.6.7 and 9.7.7). Note that operating frequency and output power level have to be adjusted first.	

Table 7-2. Fault Isolation of Alarm/Alert/Failure Indications (Contd)

Problem	Possible Cause(s)	Suggested Course of Action	
	3. Persistent fault (repetitive on event log after power cycle).	3. Check event log as described in Section 10.6.5.6.3. If the condition persists, replace the radio (see Sections 7.4.3 and 7.4.4).	
Elapsed Time Alert	This alert will occur when the internal elapsed time clock has failed to update. This alert is a "report" only and will not effect normal operation of the transmitter.		
	1. Intermittent fault (not repetitive on event log after power cycle).	1. Check event log as described in Section 10.6.5.6.3. Cycle power to the radio. Turning the power off and then back on may clear the fault.	
	2. Elapsed time clock has failed to update.	2. If the condition persists (check event log as described in Section 10.6.5.6.3), replace the radio (see Section 7.4.3 and 7.4.4).	
Low Output Power Alert	Mistuned cavity filter. Lower Power Limit set too low.		
	Intermittent fault (not repetitive on event log after power cycle).	1. Check event log as described in Section 10.6.5.6.3. Cycle power to the radio. Turning the power off and then back on may clear the fault.	
	2. Mistuned cavity filter.	2. In the fixed tuning mode, make sure cavity filter is properly aligned (see Sections 9.6.5 and 9.7.5).	
	3. Lower Power Limit set too low.	Check the Low Power Limit setting on the front panel of the MDT. Set the RF Power Level (see Sections 9.6.6 and 9.7.6).	
Transmitter Timeout Alert	This alert condition is set when the Transmitter Timeout Limit has been exceeded and the transmitter is sent to the receive mode while the PTT button is pressed. This Alert will	Release the PTT button to clear the Alert.	

Table 7-2. Fault Isolation of Alarm/Alert/Failure Indications (Contd)

Problem	Possible Cause(s)	Suggested Course of Action	
	clear when the transmitter is put into the receive mode (PTT button is released).		
ALC Failure	ALC voltage detected below lower threshold, if the transmitter is not connected to a good load, it may oscillate, and the ALC loop will not close.		
	1. Incorrect or missing connections.	1. Check to make sure RF Out cable is connected to the antenna, and that all cables are good.	
	2. Intermittent fault (not repetitive on event log after power cycle).	2. Check event log as described in Section 10.6.5.6.3. Cycle power to the radio. Turning the power off and then back on may clear the fault.	
	3. Persistent fault (repetitive on event log after power cycle).	3. Check event log as described in Section 10.6.5.6.3. If the condition persists, replace the radio (see Sections 7.4.3 and 7.4.4).	
PTT Failure	Not in Fixed tuning mode. Cavity filter mistuned.		
	1. Intermittent fault (not repetitive on event log after power cycle).	1. Check event log as described in Section 10.6.5.6.3. Cycle power to the radio. Turning the power off and then back on may clear the fault.	
	2. Cavity filter mistuned	Tune the cavity filter (see Sections 9.6.5/9.7.5). When tuning the cavity filter, make sure you are in fixed tuning mode. If not, PTT Failure will occur when cavity filter is mistuned and the transmitter will unkey.	
	3. Persistent fault (repetitive on event log after power cycle).	3. Check event log as described in Section 10.6.5.6.3. If the condition persists, replace the radio (see Sections 7.4.3 and	

Table 7-2. Fault Isolation of Alarm/Alert/Failure Indications (Contd)

Problem	Possible Cause(s)	Suggested Course of Action
		7.4.4).
Synth1 Fequency	This fault indicates that the internal Synthesizer has not locked on frequency. The transmitter will be prevented from transmitting because the frequency may not be correct. It may be possible to correct this condition by cycling the power to the unit.	
	1. Intermittent fault (not repetitive on event log after power cycle).	1. Check event log as described in Section 10.6.5.6.3. Cycle power to the radio. Turning the power off and then back on may clear the fault.
	2. Persistent fault (repetitive on event log after power cycle).	2. Check event log as described in Section 10.6.5.6.3. If the condition persists, replace the radio (see Sections 7.4.3 and 7.4.4).

<u>7.4 REMOVAL/REPLACEMENT PROCEDURES</u>.- This section provides removal/replacement procedures of AC and DC fuses and removal/replacement of the transmitter from the rack.

7.4.1 Remove /Replace AC Fuses. The CM-300 UT has two 2 A 250 V, 5X20 mm fuses and the CM-350 UT has two 8 A 250 V, 5X20 mm fuses. These fuses are located just above the 120 VAC/60 Hz power connector at the rear panel. The fuses are in a double pole holder (see Figure 7-1). To remove/replace the AC fuses, proceed as follows:

WARNING

High voltage and current are present at the AC and DC power connectors at the rear of the unit. Remove all power before proceeding with the removal/replacement procedures. Failure to do so, may result in serious bodily injury.

WARNING

Use the front panel handles when handling the transmitter. Avoid touching the heat sinks, on either side of the transmitter. The heat sinks may be hot enough to cause serious skin burns.

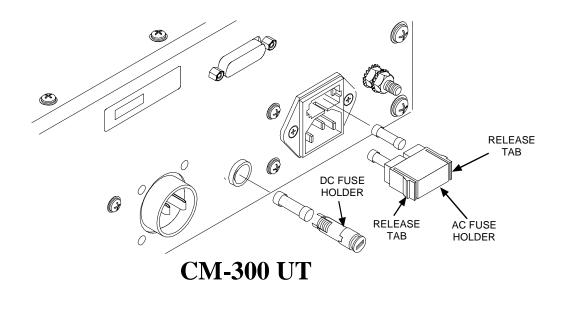
NOTE

The CM-350 UT power LEDs take approximately 10 seconds to bleed off.

- 1. Pull fuse holder out.
 - a. On the CM-300 UT, grab and squeeze inwards the release tabs on either side of the fuse holder and pull the fuse holder out.
 - b. On the CM-350 UT, using a small flat-head screwdriver, push up the release tab at the bottom of the fuse holder and pull the fuse holder out.
- 2. Pull fuses out of the fuse holder and replace with new fuses (see Table 8-1 for part numbers).
- 3. Place fuse holder into fuse cavity and push gently until it locks into place.

CAUTION

On the CM-350 UT, leave the 120/240 VAC selector jumper to the factory-set position of 120 VAC. Not recommended for 240 VAC use.



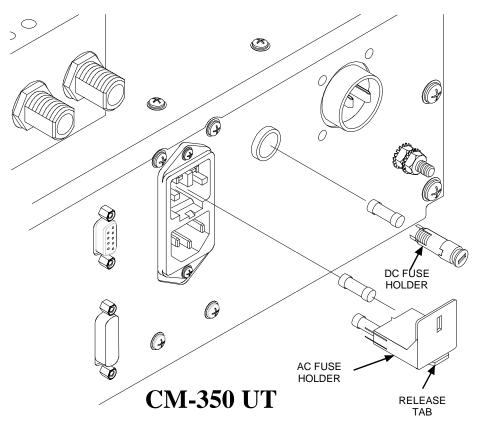


Figure 7-1. Remove/Replace AC and DC Fuses

7.4.2 Remove /Replace DC Fuse. The CM-300 UT has a 10 A 250 V, 5X20 mm fuse and the CM-350 UT has a 20 A 32 V, 3AG fuse. The fuse is located next to the 24 VDC IN power connector at the rear panel and is held in single pole spring-loaded holder (see Figure 7-1). To remove/replace the DC fuse, proceed as follows:

WARNING

High voltage and current are present at the AC and DC power connectors at the rear of the unit. Remove all power before proceeding with the removal/replacement procedures. Failure to do so, may result in serious bodily injury.

WARNING

Use the front panel handles when handling the transmitter. Avoid touching the heat sinks, on either side of the transmitter. The heat sinks may be hot enough to cause serious skin burns.

NOTE

The CM-350 UT power LEDs take approximately 10 seconds to bleed off.

- 1. Using a flat-head screwdriver, push the DC fuse holder gently inwards and turn counterclockwise (about one half turn) until the fuse holder pops out.
- 2. Pull fuse out of holder and replace with new fuse (see Table 8-1 for part number).
- 3. Place fuse holder into fuse cavity and push gently inwards. Turn clockwise (about one half turn) until the fuse holder locks into place.

7.4.3 Remove Transmitter From the Rack. Refer to Figure 7-2 and proceed as follows:

WARNING

High voltage and current are present at the AC and DC power connectors at the rear of the unit. Remove all power before proceeding with the uninstallation procedures. Failure to do so, may result in serious bodily injury.

WARNING

Use the front panel handles when handling the transmitter. Avoid touching the heat sinks, on either side of the transmitter. The heat sinks may be hot enough to cause serious skin burns.

WARNING

The CM-350 UT transmitter requires a two-person lift. A one-person lift should not be attempted as this may result in serious bodily injury.

NOTE

The CM-350 UT power LEDs take approximately 10 seconds to bleed off.

- 1. Remove all power from the transmitter.
- 2. Remove the front panel hold down screws.
- 3. Remove all cables and ground straps.
- 4. Slide the transmitter out from the rack until it hits the slide stops and disconnect the rear panel attached cables.
- 5. On the rear of each slide, left and right, press the slide release buttons, pulling the transmitter and inner slide assembly out from the rack.
- 6. Remove the inner slide from the transmitter to facilitate packing. Refer to Section 9.3.2.

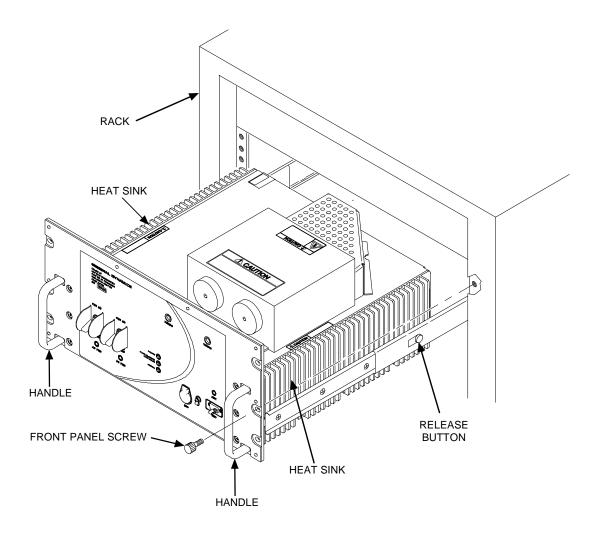


Figure 7-2. Remove/Replace Transmitter

7.4.4 Replace Transmitter Into the Rack.- Refer to Figure 7-2 and proceed as follows:

NOTE

Each slide pair is made up of separate inner and outer pieces. Prior to shipping/replacement, the inner slide will need to be removed from the faulty transmitter and re-attached to the replacement transmitter before rack installation. Refer to Section 9.3.2.

WARNING

High voltage and current are present at the AC and DC power connectors at the rear of the unit. Remove all power before proceeding with the uninstallation procedures. Failure to do so, may result in serious bodily injury.

WARNING

Use the front panel handles when handling the transmitter. Avoid touching the heat sinks, on either side of the transmitter. The heat sinks may be hot enough to cause serious skin burns.

WARNING

The CM-350 UT transmitter requires a two-person lift. A one-person lift should not be attempted as this may result in serious bodily injury.

- 1. Install inner slide onto replacement transmitter. Refer to Section 9.3.2.
- 2. Lift the replacement transmitter into position, and mate the transmitter slides to the rack slides.
- 3. Push the transmitter part way into the rack leaving enough room to attach the cables to the transmitter rear panel.
- 4. Connect the cables to the transmitter as described in paragraph 9.3.4.
- 5. Push the transmitter the rest of the way into the rack being careful not to pinch or bind the cables.
- 6. Once the transmitter is fully seated, install hold down screws into the rack through the slots at both sides of the front panel.

<u>7.5 OPERATIONAL CHECKS</u>.- Perform operational checks to verify proper operation. Refer to Sections 9.6 and 9.7.

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SECTION 8 PARTS LIST

- $\underline{8.1}$ INTRODUCTION.- This section provides a list of spare parts (to the LRU level) together with their manufacturer and part number.
- <u>8.2 WARRANTY INFORMATION</u>.- Parts under warranty. Refer to Appendix A for warranty information.
- <u>8.3 PARTS LIST</u>.- A list of parts, together with their manufacturer, part number, and NSN, is provided in Table 8-1.

Table 8-1. CM-300 UT/CM-350 UT Parts List

		Part Number		
Part Description	Manufacturer	CM-300 UT	CM-350 UT	NSN
CM-300 UT UHF transmitter, 10 W	General Dynamics Decision Systems	01-P40400G001		5895-01-505-7139
CM-350 UT UHF transmitter, 50 W	General Dynamics Decision Systems		01-P40200G001	6030-01-505-7163
Technical Instruction Book (TI 6610.20)	General Dynamics Decision Systems	68-P40408G	68-P40408G	7610-01-511-7744
AC Fuse 2 A 250 V	Schurter	0001.1007		5920-01-514-2309
DC Fuse 10 A 250 V	Schurter	0001.1014		5920-01-514-2307
AC Fuse 8 A 250 V	Schurter		0001.2513	5920-01-339-3084
DC Fuse 20 A 32 V	Littlefuse		313-020	5920-00-057-2306
CM-300 UT KIT Contains the items below	General Dynamics Decision Systems	67-P40460G		
CM-350 UT KIT Contains the items below	General Dynamics Decision Systems		67-P40260G	
- Jumper Cables	General Dynamics Decision Systems	30-P40236G001	30-P40236G001	
-AC Power Cable		0EM-0299	0EM-0299	

Table 8-1. CM-300 UT/CM-350 UT Parts List (Contd)

		Part Number		
Part Description	Manufacturer	CM-300 UT	CM-350 UT	NSN
-DC Power Cable	General Dynamics Decision Systems	30-P30121P002	30-P30121P003	
-Slide Package		CC7502-00-0160	CC7502-00-0160	
-Interface Connector Mating Receptacle Kit DB-15				
Receptacle	AMP/Tyco Electronics	205205-2	205205-2	
Contact	AMP/Tyco Electronics	66504-9	66504-9	
Backshell	AMP/Tyco Electronics	207908-4	207908-4	
-MDT Connector Mating Plug Kit DB-9	General Dynamics Decision Systems			
Plug	AMP/Tyco Electronics	205204-3	205204-3	
Contact	AMP/Tyco Electronics	205202-7	66506-9	
Backshell	AMP/Tyco Electronics	207908-1	207908-1	

SECTION 9

INSTALLATION, INTEGRATION, AND CHECKOUT

- <u>9.1 INTRODUCTION.</u>- This section contains instructions for packing and unpacking, installing, integrating, tuning and checking out the CM-300 UT and CM-350 UT transmitters. Unless specific applicability is noted, the information presented will apply to both the CM-300 UT and the CM-350 UT.
- 9.2 UNPACKING AND PACKING. Two different methods are used to pack the transmitter for shipping depending upon whether or not the transmitter is to be stored for long periods of time once it reaches its destination (as in the case of spares). In all cases, the transmitters are wrapped in plastic, encased in a two-piece, molded foam shell and shipped in a cardboard container. Transmitters that are to be stored for long periods are also packed with a moisture-absorbing desiccant, and sealed in a plastic outer bag before being placed in the container. The bag should only be opened for inspection or when the transmitter is ready for use. Check the outside of the container before opening for a label that indicates the unit was packed by "Method 2" packaging. If the container is labeled as such, be extremely careful when opening the container not to cut or tear the sealed plastic bag that surrounds the unit.
- 9.2.1 Unpacking.- To unpack, open the outer cardboard container, and remove the top half of the two-piece molded shell. This will expose the bag containing the slides, cables, manual and other accessories that is taped to the top of the transmitter. Cut the tape and remove these items, then pull the transmitter up and out of the bottom half of the molded insert. Once unpacked, the transmitter should be inspected for broken connectors, damaged switches, or other damage. Verify the contents of the shipping container against the packing list and Table 1-4 to insure all cables, slides, and hardware are included. Retain the packing list and the shipping container until the transmitter has been installed and is operating properly. Table 1-2 lists packed and unpacked transmitter dimensions.
- 9.2.2 Packing.- If possible, the original shipping container and molded foam shell should be retained and used to pack the transmitter for later shipping. To pack the transmitter, wrap the transmitter in plastic and seat in the bottom half of the foam shell. Place the top half of the foam insert over the transmitter, and place entire unit inside the shipping container. Tape the container closed with strapping or package tape. If the original packing materials are not available, the transmitter should be packed in a cardboard container surrounded on all sides by a rigid foam so that the transmitter does not shift in the container. Tape the container closed with strapping or package tape.

- 9.3 INSTALLATION. The transmitter is designed to be installed into a standard 19 inch wide, 22 inch depth rack. A slide kit containing two pairs of slides, plus the necessary hardware, is provided for installation of the transmitter into the rack. Install the slides according to the instructions in paragraph 9.3.2. Rack mounting brackets must also be installed, but are not supplied with the transmitter. Information on the rack mounting brackets is found in paragraph 9.3.1. Once the slides and rack mounting brackets are installed, the transmitter can be installed in the rack according to instructions in paragraph 9.3.3, and the cabling connections can be made per paragraph 9.3.4.
- <u>9.3.1 Rack Mounting Brackets</u>.- Figure 9-1 shows drawings of the rack mounting brackets required for installation of the transmitter. These rack mounting brackets can also be modified for installation of the transmitter into other racks. Four rack mounting brackets are required for fixed installation (Figure 9-2). The rack mounting brackets can be ordered. See Table 1-5 for NSN.

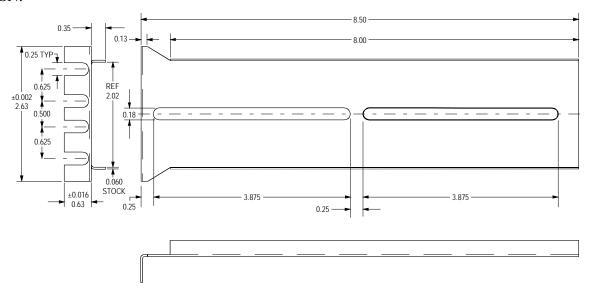


Figure 9-1. Rack Mounting Brackets

9.3.2 Slides. Each slide rail pair must be separated into its inner and outer pieces prior to installation. Attach the outer pieces of each pair to the corresponding rack mounting brackets in the rack, with the rubber stop positioned towards the rear of the rack as shown in Figure 9-2. Attach the inner pieces of each pair of slides to each side of the transmitter chassis as shown in Figure 9-3. Take care to position the slides on either side of the transmitter chassis so that the slide release is at the rear of the chassis.

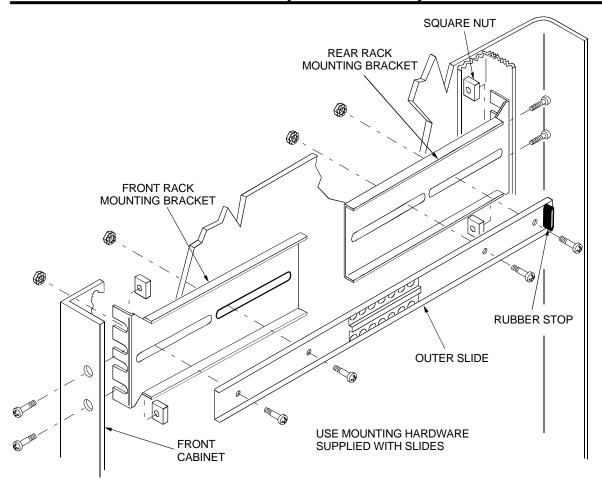


Figure 9-2. Installation of Slide and Rack Mounting Brackets to Rack

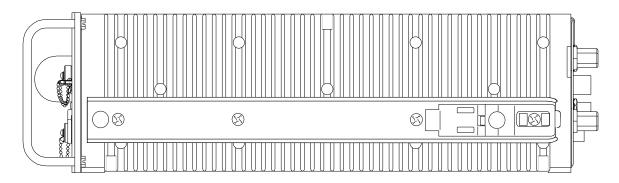


Figure 9-3. Installation of Slides to Transmitter

- 9.3.3 Installing the Transmitter Into the Rack. Make sure the mounting brackets and slides are installed as shown in Figures 9-2 and 9-3. Install transmitter into the rack as described in Section 7.4.4.
- 9.3.4 Cabling Connections. The location of front and rear panel connectors are illustrated in Figures 3-1 through 3-4 and described in Tables 3-1 through 3-4. The pin outs and electrical signal descriptions for the REM INT, MDT, 120 VAC/6 Hz, 24 VDC IN, and MIC connectors are listed in Tables 3-5 through 3-9. The REM INT and MDT pin locations are shown in Figures 3-5 and 3-6. Figure 9-4 below provides a block diagram view of the front and rear panel connectors and their destination.

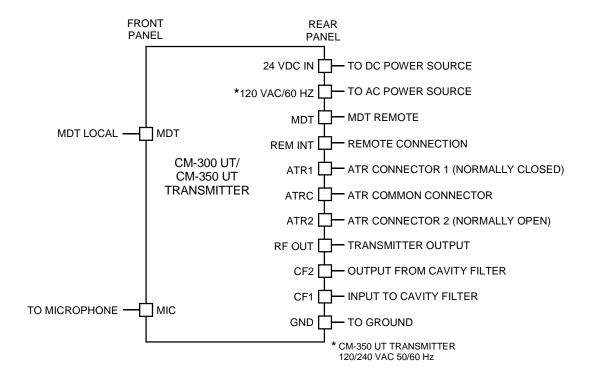


Figure 9-4. Cabling Connections

Connect permanent cables as follows:

 Connect the AC power cord to the 120 VAC 60 Hz (120/240 VAC 50/60 Hz on the CM-350 UT) power input on the transmitter back panel, and connect the other end to an AC power source.

CAUTION

On the CM-350 UT, leave the 120/240 VAC selector jumper to the factory-set position of 120 VAC. Not recommended for 240 VAC use.

NOTE

When the DC PWR ON switch is in the ON position, the transmitter will draw a small amount of current from the DC power source to light the front panel DC PWR LED. Because of this, if a battery is connected to the DC power input, it may eventually be drained unless it is connected to a charging circuit.

- 2. Connect the DC power cord to the 24 VDC IN power input on the transmitter back panel, and connect the other end to a 24 VDC power source.
- 3. Connect the antenna cable to the ATRC connector on the transmitter back panel. For a standby transmitter in the transmitter/transmitter configuration, connect the antenna cable to the main transmitter ATRC connector (see Figures 1-4 through 1-8).
- 4. Connect the Remote Interface cable to the REM INT connector on the transmitter back panel. If the connector on the Remote Interface cable is not compatible with the mating connector on the transmitter, assemble the new connector and back shell (supplied with the transmitter). Follow the assembly instructions in Section 9.3.5.
- 5. Connect a strap from the GND ground post on the transmitter back panel to ground on the equipment rack. A 0.125 inch tin-coated copper braid is preferred.
- 6. Use jumper cables provided (with the transmitters) to accomplish the required equipment configuration. See Sections 1.3.1 through 1.3.4 and Figures 1-4 through 1-8, as required.
- 9.3.5 Assembly Instructions for the REM INT and MDT Connector Mates.- The REM INT connector mate is a 15-socket receptacle. The MDT connector mate is a 9-pin plug. The parts required for this assembly consist of a receptacle or plug, contacts, and backshell, supplied with the radio (see Table 1-4). The contacts are crimp type and require a crimping tool to install (see Figure 9-5).

Section 1, Table 1-4, lists the part numbers for the receptacle, plugs, contacts, and backshells. Table 1-5 lists the part number for the crimping tool. Tables 3-5 and 3-6 give the signal descriptions for the mating connectors for the REM INT and MDT connectors respectively.

NOTE

Before using the crimping tool to crimp desired contacts, verify and adjust the crimp height according to manufacturer's specification. 20 AWG wire should be used.

Refer to Figure 9-5, and proceed as follows:

- 1. On the REM INT or MDT cable, label the wires with correct pin number (see Figures 3-5 and 3-6 and Tables 3-5 and 3-6).
- 2. Slip the replacement connector backshell, supplied with the radio, over the cable.
- 3. Strip the ends of the wires back approximately 2.54 mm (0.1 inches) taking care not to nick or cut wire strands.

- 4. Select applicable contacts and identify the appropriate crimping chamber according to the wire size marking on the crimping tool.
- 5. Hold the crimping tool so that the front (locator side) is facing you. Squeeze handles together and allow them to open fully.
- 6. Insert contact, mating end first, into the hole in the locator which corresponds with the appropriate crimping chamber. Make sure that the open "U" of the wire barrel and insulation barrel face the stationary jaw.

CAUTION

Do not attempt to close the tool handles when the locator contact retainer is between the dies. Damage to the tool jaws or locator may result.

7. Slide the locator contact retainer out from between the dies (spring tension will pull the locator down). Make sure that the wire stop enters the contact wire stop slot between the wire barrel and contact shoulder. Release contact retainer.

CAUTION

Make sure that both sides of the contact insulation barrel are started evenly into the crimping chamber. Do NOT attempt to crimp an improperly positioned contact.

- 8. Hold the contact in position and squeeze the tool handles together until ratchet engages sufficiently to hold the contact in position. Do NOT deform insulation barrel or wire barrel.
- 9. Insert stripped wire into contact insulation and wire barrels until it is butted against the wire stop.
- 10. Holding the wire in place, squeeze tool handles together until ratchet releases. Allow tool handles to open and remove crimped contacts.
- 11. Repeat steps 4 through 10 for all of the wires.
- 12. Using an insertion tool, insert the crimped pins (or sockets) into the appropriate holes (see Figures 3-5 and 3-6) on the connector body making sure they are firmly seated.
- 13. Once all contacts have been inserted into connector, assemble connector backshell to connector body.

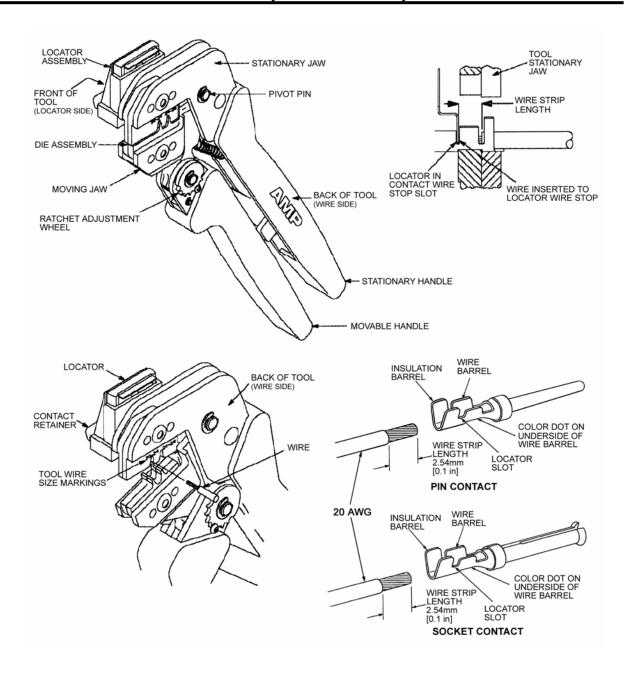


Figure 9-5. Crimping Tool and Contacts

- 9.4 INTERFACE CHARACTERISTICS. Connector Interface Pin Outs for the REM INT, MDT, 120 VAC/60 Hz, 24 VDC IN, and MIC connectors are listed in Tables 3-5 through 3-9. Pin locations for the REM INT and MDT connectors are shown in Figures 3-5 and 3-6.
- 9.5 MDT CONNECTION, UHF MDT SOFTWARE INSTALLATION, AND MDT SET-UP. This information is provided in Sections 10.3, 10.4, and 10.5.
- <u>9.6 CM-300 UT SET-UP AND OPERATIONAL CHECKOUT</u>.- This section provides instructions on how to perform the set-up and operational checkout procedures. These procedures should be performed in the order shown below:
 - 1. Set the CM-300 UT address Section 9.6.1.
 - 2. Set the CM-300 UT operating frequency Section 9.6.2.
 - 3. Adjust the CM-300 UT reference frequency Section 9.6.3.
 - 4. Set the CM-300 UT RF tuning mode Section 9.6.4.
 - 5. Tune the CM-300 UT cavity filter Section 9.6.5.
 - 6. Check the CM-300 UT RF power output and set the lower power limit Section 9.6.6.
 - 7. Check the CM-300 UT modulation level and set the modulation limiter level Section 9.6.7.
 - 8. Set the CM-300 UT ATR relay Section 9.6.8.
 - 9. Set the CM-300 UT timeout Section 9.6.9.

These procedures assume that:

- The transmitter has been properly installed as described in Section 9.3.
- The transmitter has been cabled as described in Section 9.3.
- The transmitter has been powered up as described in Section 3.5.
- The MDT is connected to the transmitter as described in Section 10.3.
- The MDT software is loaded as described in Section 10.4.
- The user is familiar with the operation of the front panel controls and indicators as described in Section 3.2.
- The user is familiar with the operation of the UHF MDT software (GUI) as described in Section 10.
- The radio is at its factory default settings.

NOTE

To ensure the radio is at its default settings a factory reset should be performed. To perform a factory reset, refer to Section 10.6.5.4.5.

When using the UHF MDT Software to make changes to the radio parameters, change one parameter at a time. Click on Apply (or OK) to apply the change before proceeding with further changes.

NOTE

Set the transmitter timeout to CONT (see Section 10.6.5.4.10) or the transmitter may time out during the procedure.

NOTE

The modulation limiter level and the modulation index level are highly dependent upon the operating frequency and the output power level. In order to ensure the radio is set up correctly, the following sequence should always be used when modifying any of these parameters.

- 1. Set operating frequency (See Section 9.6.2).
- 2. Tune cavity filter if in Fixed Tuning Mode (see Section 9.6.5).
- 3. Set continuous wave (CW) output power level (See Section 9.6.6).
- 4. Set modulation limiter level (See Section 9.6.7.2).
- 5. Set modulation index level (See Section 9.6.7.3).

9.6.1 Set CM-300 UT Radio Address. The radio may be set to any one of 16 addresses. The radio address is set by the binary state of pins 1 (ADDR_0), 2 (ADDR_1), 9 (ADDR_2), and 10 (ADDR_3) of the REM INT connector (see Table 9-1). The binary state of these pins is set by the state of the corresponding pins on the mating cable connector. These wires may be connected to pin 12 (GND) of the REM INT cable connector to provide the addresses listed in Table 9-1. The default address is 15.

Ground = 0 N/C = 1

Table 9-1. Transmitter Address

Pin 10 (ADDR_3)	Pin 9 (ADDR_2)	Pin 2 (ADDR_1)	Pin 1 (ADDR_0)	Radio Address
0	0	0	0	00
0	0	0	1	01
0	0	1	0	02
0	0	1	1	03
0	1	0	0	04
0	1	0	1	05
0	1	1	0	06
0	1	1	1	07
1	0	0	0	08
1	0	0	1	09
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

- <u>9.6.2 Set CM-300 UT Operating Frequency</u>.- The purpose of this procedure is to set the transmitter operating frequency. This procedure is performed through the MDT (see Section 10.6.5.4.1).
- 9.6.3 Adjust CM-300 UT Reference Frequency. The purpose of this procedure is to determine if the internal reference oscillator frequency is within specified limits. The measurement is made at the transmitter output, at the transmitter operating frequency, but the check will still verify the frequency of the reference oscillator.

9.6.3.1 Test Equipment.-

- HP5385A Frequency Counter, or equivalent
- JFW 50FH-020-100 20 dB Attenuator, or equivalent
- MDT

9.6.3.2 Procedure.-

- 1. Set the frequency counter to measure the frequency of the transmitter.
- 2. Connect one end of the 20 dB Attenuator to the transmitter RF OUT as shown in Figure 9-6.
- 3. Connect the other end of the 20 dB Attenuator to the Frequency Counter input as shown in Figure 9-6.

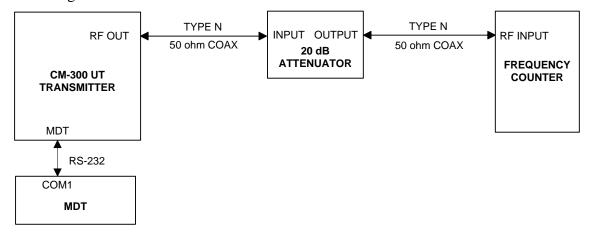


Figure 9-6. CM-300 UT Reference Frequency Adjustment

- 4. Connect the MDT (see Section 10.3) and key the transmitter using the MDT (see Section 10.6.5.4.12).
- 5. Measure transmitter frequency. If the tolerance on the frequency does not meet the requirements of Section 4, tune the frequency using the following procedure by selecting the Front Panel of the MDT and adjust the Reference Frequency (see Section 10.6.5.4.3).

It may be necessary to increase the output power level in order for the frequency counter to make the measurements. If required, change the output power level using the MDT (see Section 9.6.6).

- 6. Measure and record the frequency on the appropriate form, as required.
- 7. Unkey the Transmitter using the MDT (see Section 10.6.5.4.12).
- 9.6.4 Set CM-300 UT RF Tuning Mode (Remote/Fixed).- The purpose of this procedure is to set the transmitter to either the Fixed Tuning Mode or the Remote Tuning Mode. This procedure is performed through the MDT (see Section 10.6.5.4.2).
- 9.6.5 Tune CM-300 UT Cavity Filter (Fixed Tuning Mode Only). This tuning procedure is to adjust both ports (use ¼-inch hex wrench) on the cavity filter for peak response at the transmitter frequency. The cavity filter on the 10-watt transmitter is connected in series with the final RF output.

NOTE

Skip to Section 9.6.6 if setting up Remote Tuning Mode.

9.6.5.1 Test Equipment and Tools.-

- Bird 43 Wattmeter, or equivalent
- JFW-50T-032-1:1 Dummy Load (100 W), or equivalent
- MDT
- ½-inch hex wrench

9.6.5.2 Procedure.-

1. Connect a Bird model 43 wattmeter, or equivalent, to the transmitter ATRC connector and connect the dummy load to the other wattmeter port as shown in Figure 9-7. Ensure that the cabling is configured to use the cavity filter (Fixed Tuning Mode).

When using a transmitter/transmitter configuration, the standby transmitter must be cabled to the main transmitter ATR. Refer to Figure 1-8 for cabling diagram.

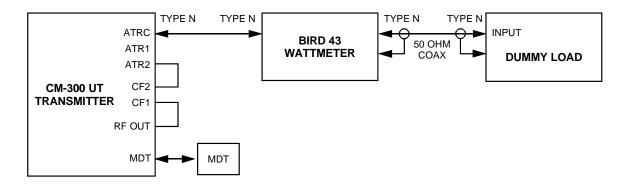


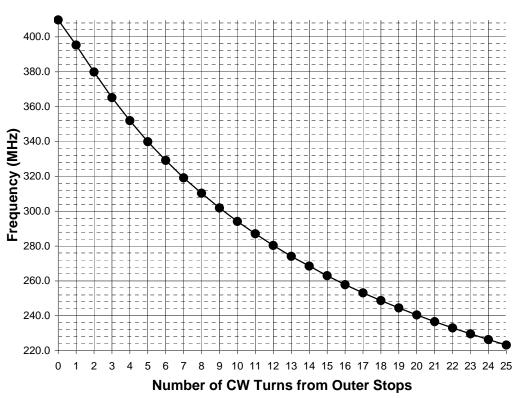
Figure 9-7. CM-300 UT Cavity Filter Adjustment

- 2. Insert either a 2.5 or 5 watt element in the wattmeter.
- 3. Remove the tethered plugs from the upper and lower TUNING ports.
- 4. Connect the MDT (see Section 10.3), ensure the RF tuning mode is set to Fixed (see Section 10.6.5.4.2), and set the transmit power output to 001 using the MDT (see Section 10.6.5.4.8).

NOTE

Setting the Power Level to 001 when the RF Tuning Mode is set to Fixed puts the transmitter into a special mode. This allows the radio to continue to transmit even in the event of a reported fault.

- 5. Using a ¼-inch hex wrench, adjust upper TUNING port and lower TUNING port **counterclockwise** until rotation stops. Be careful to use minimum force as the tuning slugs approach the end of their adjustment range to prevent damage.
- 6. On the cavity filter tuning chart, Figure 9-8, locate the typical number of turns required to preset filter to operating frequency.



CM300 UT Cavity Filter Tuning Curve

Figure 9-8. CM-300 UT Cavity Filter Tuning Preset Chart

NOTE

The graph for the setting above is approximate. External test equipment should be used to verify the setting.

- 7. Using a ¼-inch hex wrench, adjust upper TUNING port and lower TUNING port **clockwise** the number of turns found in step 6.
- 8. Key the transmitter using the MDT (see Section 10.6.5.4.12).

NOTE

During the initial stages of cavity filter alignment, it is possible that the transmitter will send an Alert and/or Alarm condition on power out. This should clear after final alignment is finished.

9. Alternately, using a ¼-inch hex wrench, adjust upper TUNING port and lower TUNING port in approximately 1/8 turn increments, until the indication on the wattmeter rises to a peak. This peak is typically more than 100 mW.

It is possible to go through a null before reaching the peak.

- 10. Use the MDT to unkey the transmitter (see Section 10.6.5.4.12). Change the wattmeter element to 10 Watts.
- 11. Using Figure 9-12 set the transmitter to approximately 7 Watts operating power with the MDT (see Section 10.6.5.4.8).

NOTE

This power output setting is temporary, the final output power will be set and verified in the following procedure.

- 12. Key the radio (see Section 10.6.5.4.12).
- 13. Again adjust both tuning ports until the power reaches maximum level. When optimized, any adjustment to either port reduces output power.
- 14. The filter is now tuned.
- 15. Unkey the Transmitter using the MDT (see Section 10.6.5.4.12).
- 16. Replace the tethered plugs into the TUNING ports.

9.6.6 Check CM-300 UT RF Power Output and Set the Lower Power Limit (Remote/Fixed). The purpose of this section is to provide procedures that will verify the power output level of the transmitter and that will set the lower power limit threshold for generating an Output Power Alert. There are two graphs that show the approximate power level settings to achieve desired power levels. Figure 9-11 should be used if the transmitter is in Remote Tuning Mode and Figure 9-12 should be used if the transmitter is in Fixed Tuning Mode. The Lower Power Limit is a coarse threshold value that will generate an Output Power Alert if output power does not exceed the power level represented by the threshold. It is recommended that the user set the Lower Power Limit at or below the half power point (-3 dB) of the desired normal RF Power Output.

9.6.6.1 Test Equipment.-

- Bird 43 Wattmeter, or equivalent
- JFW-50T-032-1:1 Dummy Load (100 W), or equivalent
- MDT

9.6.6.2 Procedure for Setting the Lower Power Limit.-

1. If the radio is to be used in the Remote Tuning Mode, connect the equipment as shown in Figure 9-9. If the radio is to be used in the Fixed Tuning Mode, connect the equipment as shown in Figure 9-10.

NOTE

When using a transmitter/transmitter configuration, the standby transmitter must be cabled to the main transmitter ATR. Refer to Figure 1-8 for cabling diagram.

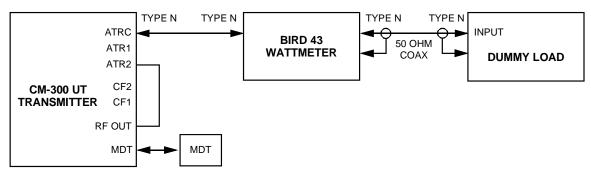


Figure 9-9. CM-300 UT RF Power Output Check (Remote Tuning Mode)

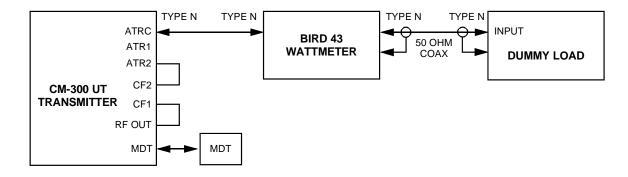


Figure 9-10. CM-300 UT RF Power Output Check (Fixed Tuning Mode)

- 2. Ensure the radio is set to the proper RF Tuning Mode using the MDT (see Section 10.6.5.4.2).
- 3. Set the Lower Power Limit threshold using the following procedures:
 - a. Connect the MDT (see Section 10.3) and access the CM-300 UT Detail Window (see Section 10.6.4.3).
 - b. If an Output Power Alert is not desired, then enter 000 for the Lower Power Limit and click the Apply button. Skip to section 9.6.6.3.
 - c. In the Front Panel tab, change the Power Level (see Section 10.6.5.4.8) to the desired output level (from Figure 9-11 for Remote Tuning Mode or Figure 9-12 for Fixed Tuning Mode) at which you would like to receive an Output Power Alert.

NOTE

Radios have a factory-set maximum power level and will not allow values above this limit. This limit is frequency dependent and also will change depending on the RF Tuning Mode (Remote/Fixed).

- d. Click on the Apply button to apply all changes to the MDT.
- e. Key the transmitter (see Section 10.6.5.4.12).
- f. While monitoring the wattmeter, increase or decrease the Power Level setting (see Section 10.6.5.4.8) to meet the desired output level (from Figure 9-11 or Figure 9-12) at which you would like to receive an Output Power Alert.
- g. Click on the Apply button to apply all changes to the MDT.
- h. In the Front Panel tab, starting at 0, increase the Lower Power Limit (see Section 10.6.5.4.9) in increments of 5 then apply the changes by clicking the Apply button. Continue until an Alert is indicated on the radio. The Alert should be verified as an Output Power Alert in the Summary Fault Status Window (See Section 10.6.5.4.4).
- i. Unkey the transmitter (see Section 10.6.5.4.12).

9.6.6.3 Procedure for Setting the RF Power Output.-

- 1. Using Figure 9-11 for Remote Tuning Mode or Figure 9-12 for Fixed Tuning Mode, as a guide, change the Power Level (see Section 10.6.5.4.8) to the desired RF Power Output level.
- 2. Key the transmitter using the MDT (see Section 10.6.5.4.12).
- 3. Measure the transmitter output power. If power out does not meet the requirements, adjust using the following procedure:
 - a. While monitoring the wattmeter, increase or decrease the power setting by clicking on the up or down arrows to the right side of the Power Level (see Section 10.6.5.4.8) to meet the power out requirements.
 - b. Click on the Apply button to apply all changes to the MDT.
 - c. Continue to repeat steps a and b until the power output meets requirements.
- 4. Unkey the transmitter using the MDT (see Section 10.6.5.4.12).

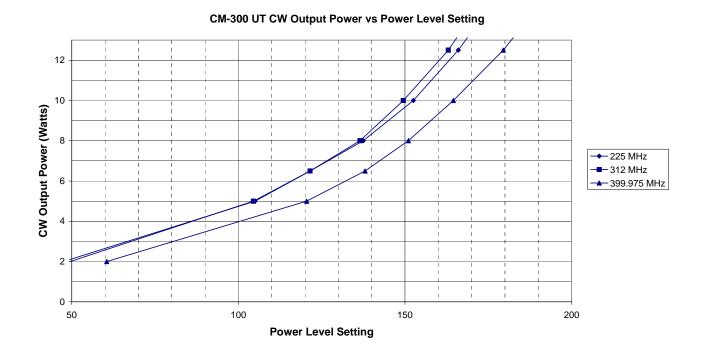


Figure 9-11. CM-300 UT Power Output Vs Power Level Setting (Remote Tuning Mode)

The graph for the setting above is approximate. External test equipment should be used to verify the setting.

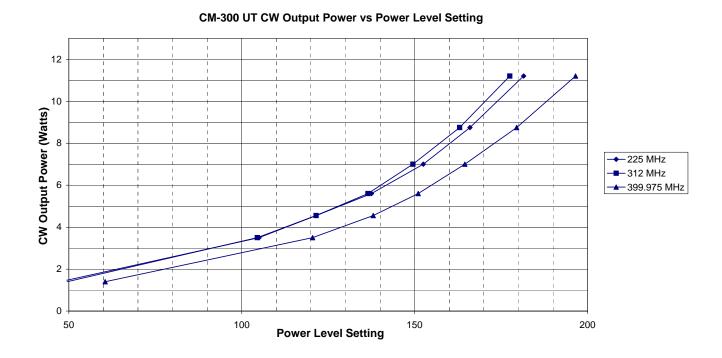


Figure 9-12. CM-300 UT Power Output Vs Power Level Setting (Fixed Tuning Mode)

The graph for the setting above is approximate. External test equipment should be used to verify the setting.

9.6.7 Check CM-300 UT Modulation Level and Set the Modulation Limiter Level

(Remote/Fixed).- The purpose of this section is to provide procedures to set the modulation limiter level and to measure and adjust the percent of modulation. The Modulation Limiter Level should be set first. A graph that shows the approximate Modulation Limiter Level setting to achieve limiting at a specific percent modulation level is included in Figure 9-15. The modulation limiter circuit will limit the audio signal in order to prevent the radio from overmodulating. The Modulation Limiter Level should be set such that limiting will begin at the desired modulation percentage plus 5% (i.e. if you want a modulation percentage of 90% then you would set up the Mod Limit Level to begin limiting the audio when the modulation percentage reaches 95%.). After the limiter level is set, you then proceed to set up your desired modulation percentage by changing the Mod Index Level. A graph that shows the approximate modulation index level setting to achieve the desired percent modulation level is included in Figure 9-16.

NOTE

The modulation limiter level and the modulation index level are highly dependent upon the operating frequency and the output power level. In order to ensure the radio is set up correctly the following sequence should be used when modifying any of these parameters.

- 1. Set operating frequency (See Section 9.6.2).
- 2. Tune cavity filter if in Fixed Tuning Mode (see Section 9.6.5).
- 3. Set output power level (See Section 9.6.6).
- 4. Set modulation limiter level (See Section 9.6.7.2).
- 5. Set modulation index level (See Section 9.6.7.3).

9.6.7.1 Test Equipment.-

- Agilent 8901 Modulation Analyzer, or equivalent
- Agilent 8903 Audio Analyzer, or equivalent
- Agilent 8904 Function Generator, or equivalent
- Tektronix 465 Oscilloscope, or equivalent
- M85/U carbon microphone, or equivalent
- JFW 50FH-020-100 20 dB Attenuator, or equivalent
- MDT

9.6.7.2 Procedure for setting the Modulation Limiter Level(Remote/Fixed).-

- 1. Set front panel controls on Audio Analyzer to measure the audio level in dBm.
- 2. Use the Audio Analyzer to set the Function Generator for 1 kHz sine wave of -8 dBm into a 600 ohm balanced load.
- 3. If the radio is to be used in the Remote Tuning Mode, connect the equipment as shown in Figure 9-13. If the radio is to be used in the Fixed Tuning Mode, connect the equipment as shown in Figure 9-14.

When using a transmitter/transmitter configuration, the standby transmitter must be cabled to the main transmitter ATR. Refer to Figure 1-8 for cabling diagram.

- 4. Ensure the radio is set to the proper RF Tuning Mode (Remote or Fixed) using the MDT (see Section 10.6.5.4.2).
- 5. Set the Modulation Limiter Level
 - a. Using either the Fixed or Remote Tuning curve from Figure 9-15 as a guide, set the Mod Limiter Level (See Section 10.6.5.4.7) to the setting that corresponds with the desired modulation percentage at which the limiting circuit will activate to prevent overmodulation of the RF signal.
 - b. Click on the Apply button to apply all changes to the MDT.
 - c. Change the Modulation Index Level to 255 by clicking on the up arrow to the right side of the Mod Index Level (See Section 10.6.5.4.6).
 - d. Click on the Apply button to apply all changes to the MDT.
 - e. Use the MDT to key the radio (See Section 10.6.5.4.12).
 - g. While monitoring the Modulation Analyzer, increase or decrease the Mod Limiter Level by clicking on the arrows to the right side of the Mod Limiter Level, followed by clicking on the Apply button, until the modulation percentage is at the desired modulation limiter level (See Section 10.6.5.4.7).

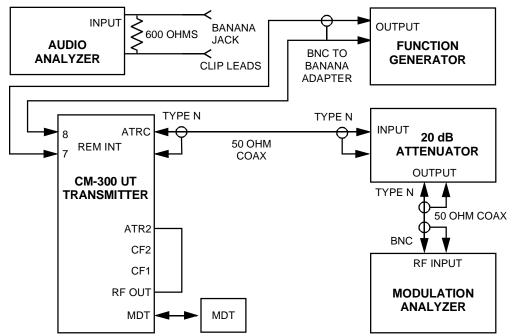


Figure 9-13. CM-300 UT Modulation Level Check (Remote Tuning Mode)

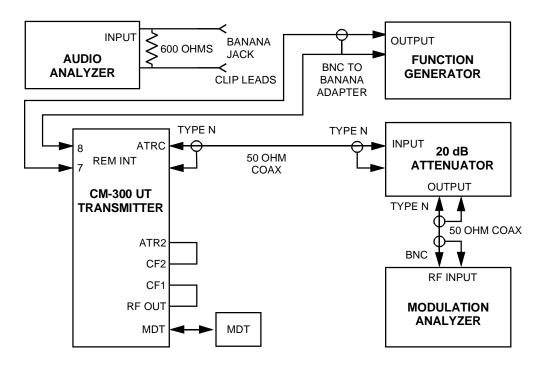
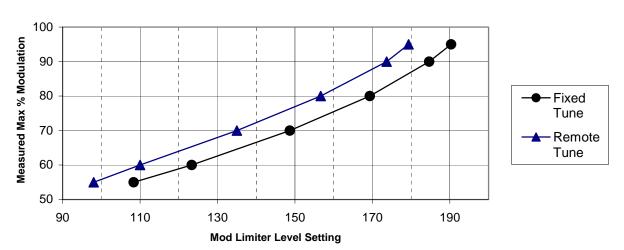


Figure 9-14. CM-300 UT Modulation Level Check (Fixed Tuning Mode)



CM-300 UT Max % Modulation vs. Mod Limiter Level Setting

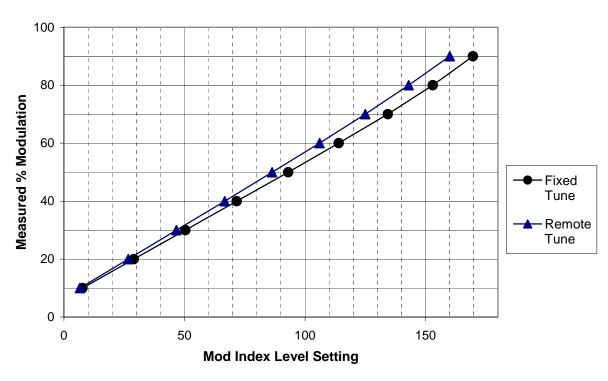
Figure 9-15. CM-300 UT Max % Modulation Vs Mod Limiter Level Setting

NOTE

The graph for the setting above is approximate. External test equipment should be used to verify the setting.

9.6.7.3 Procedure for setting the Modulation Index Level.-

- 1. Using either the Fixed or Remote Tuning curve from Figure 9-16 as a guide, set the Mod Index Level to the setting that corresponds with the desired modulation percentage (See Section 10.6.5.4.6).
- 2. Measure the modulation percentage. If the percentage does not meet the requirements, then adjust using the following procedure.
 - a. In the Front Panel tab, while monitoring the Modulation Analyzer set the Modulation Index level by clicking on the arrows to the right side of the Mod Index Level, followed by clicking on the Apply button, until the modulation percentage is at the desired level (See Section 10.6.5.4.6).
 - b. Unkey Transmitter using the MDT (see Section 10.6.5.4.12).
- 3. Perform a test count through the front panel microphone jack. Observe the oscilloscope for voice peaks not to exceed the standards and tolerances.



CM-300 UT % Modulation vs Mod Index Level Setting

Figure 9-16. CM-300 UT % Modulation Vs Mod Index Level Setting

NOTE

The graph for the setting above is approximate. External test equipment should be used to verify the setting.

9.6.8 Set CM-300 UT ATR Relay (Remote/Fixed).- There are 3 modes available: Normal, ATR1, or ATR2. Normal mode is Regular Push To Talk (PTT) control. ATR1 and ATR2 modes are intended for maintenance purposes only (see Section 10.6.5.4.11). The ATR is factory-set at Normal and should remain at that position for normal operations.

9.6.9 Set CM-300 UT Transmitter Timeout. This procedure will set the Tx Timeout in seconds. If the radio is transmitting and reaches this limit, it will stop transmitting and generate an Alert message. Factory default is at 35 seconds. This procedure is performed through the MDT (see Section 10.6.5.4.10).

- 9.7 CM-350 UT TRANSMITTER SET-UP AND CONFIGURATION. This section provides instructions on how to perform the set-up and operational checkout procedures. These procedures should be performed in the order shown below:
 - 1. Set the CM-350 UT address Section 9.7.1.
 - 2. Set the CM-350 UT operating frequency Section 9.7.2.
 - 3. Adjust the CM-350 UT reference frequency Section 9.7.3.
 - 4. Set the CM-350 UT RF tuning mode Section 9.7.4.
 - 5. Tune the CM-350 UT cavity filter Section 9.7.5.
 - 6. Check the CM-350 UT RF power output and set the lower power limit Section 9.7.6.
 - 7. Check the CM-350 UT modulation level and set the modulation limiter level Section 9.7.7.
 - 8. Set the CM-350 UT ATR relay Section 9.7.8.
 - 9. Set the CM-350 UT timeout Section 9.7.9.

These procedures assume that:

- The transmitter has been properly installed as described in Section 9.3.
- The transmitter has been cabled as described in Section 9.3.
- The transmitter has been powered up as described in Section 3.5.
- The MDT is connected to the transmitter as described in Section 10.3.
- The MDT software is loaded as described in Section 10.4.
- The operator is familiar with the operation of the front panel controls and indicators as described in Section 3.2.
- The operator is familiar with the operation of the UHF MDT software (GUI) as described in Section 10.
- The radio is at its factory default settings.

NOTE

To ensure the radio is at its default settings a factory reset should be performed. To perform a factory reset, refer to Section 10.6.5.4.5.

NOTE

When using the UHF MDT Software to make changes to the radio parameters, change one parameter at a time. Click on Apply (or OK) to apply the change before proceeding with further changes.

Set the transmitter timeout to the maximum setting (60 secs) (see Section 10.6.5.4.10). Rekey the transmitter if it times out during the procedure (see Section 10.6.5.4.12).

NOTE

When adjusting parameters on a CM-350 UT that is not installed into a rack, ensure that the CM-350 is positioned to allow airflow on all sides of the radio.

NOTE

The modulation limiter level and the modulation index level are highly dependent upon the operating frequency and the output power level. In order to ensure the radio is set up correctly the following sequence should slays be used when modifying any of these parameters.

- 1. Set operating frequency (See Section 9.7.2).
- 2. Tune cavity filter if in Fixed Tuning Mode (see Section 9.6.5).
- 3. Set continuous wave (CW) output power level (See Section 9.7.6).
- 4. Set modulation limiter level (See Section 9.7.7.2).
- 5. Set modulation index level (See Section 9.7.7.3).

- 9.7.1 Set CM-350 UT Radio Address. The radio may be set to any one of 16 different addresses. The Radio Address is set by the binary status of pins 1 (ADR_0), 2 (ADR_1), 9 (ADR_2), and 10 (ADR_3) of the REM INT connector (see Section 9.6.1).
- 9.7.2 Set CM-350 UT Operating Frequency. The purpose of this procedure is to set the transmitter operating frequency. This procedure is performed through the MDT (see Section 10.6.5.4.1).
- <u>9.7.3 Adjust CM-350 UT Reference Frequency.</u>- The purpose of this procedure is to determine if the internal reference oscillator frequency is within specified limits. The measurement is made at the transmitter output, at the transmitter operating frequency, but the check will still verify the frequency of the reference oscillator.

9.7.3.1 Test Equipment.-

- HP5385A Frequency Counter, or equivalent
- JFW 50FH-020-100 20 dB Attenuator, or equivalent
- MDT

9.7.3.2 Procedure.-

- 1. Set the frequency counter to measure the frequency of the transmitter.
- 2. Connect one end of the 20 dB Attenuator to the transmitter RF OUT as shown in Figure 9-17.
- 3. Connect the other end of the 20 dB Attenuator to the Frequency Counter input as shown in Figure 9-17.

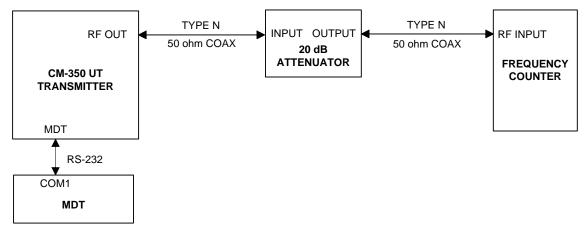


Figure 9-17. CM-350 UT Reference Frequency Adjustment

- 4. Connect the MDT (see Section 10.3) and key the transmitter using the MDT (see Section 10.6.5.4.12)
- 5. Measure transmitter frequency. If the tolerance on the frequency does not meet the requirements of Section 4, tune the frequency using the following procedure by selecting the Front Panel of the MDT and adjust the Reference Frequency (see Section 10.6.5.4.3).

It may be necessary to increase the output power level in order for the frequency counter to make the measurements. If required, change the output power level using the MDT (see Section 9.7.6).

- 6. Measure and record the frequency on the appropriate form, as required.
- 7. Unkey the Transmitter using the MDT (see Section 10.6.5.4.12).

- 9.7.4 Set CM-350 UT RF Tuning Mode(Remote/Fixed).- The purpose of this procedure is to set the transmitter to either the Fixed Tuning Mode or the Remote Tuning Mode. This procedure is performed through the MDT (see Section 10.6.5.4.2).
- 9.7.5 Tune CM-350 UT Cavity Filter (Fixed Tuning Mode Only). This tuning procedure is to adjust both ports (use ¼-inch hex wrench) on the cavity filter for peak response at the transmitter frequency. The cavity filter on the 50-watt transmitter is connected in series with the final RF output.

Skip to Section 9.7.6 if setting Remote Tuning Mode.

9.7.5.1 Test Equipment and Tools.-

- Bird 43 Wattmeter, or equivalent
- JFW 50T-032-1:1 Dummy Load (100 W), or equivalent
- MDT
- ½-inch hex wrench

9.7.5.2 Procedure.-

1. Connect a Bird 43 wattmeter, or equivalent, to the transmitter ATRC connector and connect the dummy load to the other wattmeter port as shown in Figure 9-18. Ensure that the cabling is configured to use the cavity filter (Fixed Tuning Mode).

NOTE

When using a transmitter/transmitter configuration, the standby transmitter must be cabled to the main transmitter ATR. Refer to Figure 1-8 for cabling diagram.

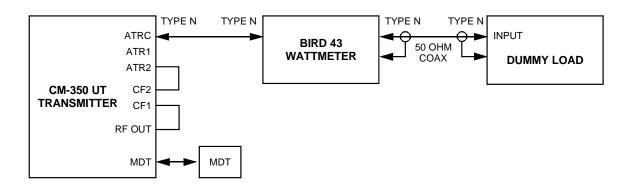


Figure 9-18. CM-350 UT Cavity Filter Adjustment

- 2. Insert 5 watt element in the wattmeter.
- 3. Ensure the RF tuning mode is set to Fixed (see Section 10.6.5.4.2).

4. Connect the MDT (see Section 10.3), and set the transmit power output to 001 using the MDT (see Section 10.6.5.4.8).

NOTE

Setting the Power Level to 001 when the RF Tuning Mode is set to Fixed puts the transmitter into a special mode. This allows the radio to continue to transmit even in the event of a reported fault.

- 5. Using a ¼-inch hex wrench, adjust left TUNING port and right TUNING port **counterclockwise** until rotation stops. Be careful to use minimum force as the tuning slugs approach the end of their adjustment range to prevent damage.
- 6. On the cavity filter tuning chart, Figure 9-19 locate the number of turns required to preset filter to operating frequency.

CM-350 UT Cavity Filter Tuning Curve

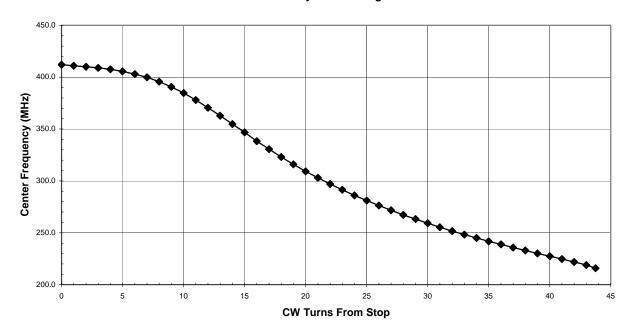


Figure 9-19. CM-350 UT Cavity Filter Tuning Preset Chart

The graph for the setting above is approximate. External test equipment should be used to verify the setting.

- 7. Using a ¼-inch hex wrench, adjust left TUNING port and right TUNING port **clockwise** the number of turns found in step 6.
- 8. Key the transmitter using the MDT (see Section 10.6.5.4.12).

NOTE

During the initial stages of cavity filter alignment, it is possible that the transmitter will send an Alert and/or Alarm condition on power out. This should clear after final alignment is finished.

9. Alternately, using a ¼-inch hex wrench, adjust left TUNING port and right TUNING port until the indication on the wattmeter rises to a peak. This peak is typically more than 2 watts.

NOTE

It is possible to go through a null before reaching the peak.

- 10. Use the MDT to unkey the transmitter (see Section 10.6.5.4.12). Change the wattmeter element to 50 Watts.
- 11. Using Figure 9-23 set the transmitter to approximately 40 Watts operating power with the MDT (see Section 10.6.5.4.8).

NOTE

This power output setting is temporary and will be set and verified in the following procedure.

- 12. Key the radio (see Section 10.6.5.4.12).
- 13. Again adjust both tuning ports until the power reaches maximum level. When optimized, any adjustment to either port reduces output power.

NOTE

At this point the adjustments should be very slight, typically less than 5 degrees of rotation.

- 14. The filter is now tuned.
- 15. Unkey the Transmitter (see Section 10.6.5.4.12).

9.7.6 Check CM-350 UT RF Power Output and Set the Lower Power Limit (Remote/Fixed). The purpose of this section is to provide procedures that will verify the power output level of the transmitter and that will set the lower power limit threshold for generating an Output Power Alert. There are two graphs that show the approximate power level settings to achieve desired power levels. Figure 9-22 should be used if the transmitter is in Remote Tuning Mode and Figure 9-23 should be used if the transmitter is in Fixed Tuning Mode. The Lower Power Limit is a coarse threshold value that will generate an Output Power Alert if output power does not exceed the power level represented by the threshold. It is recommended that the user set the Lower Power Limit at or below the half power point (-3 dB) of the desired normal RF Power Output.

9.7.6.1 Test Equipment.-

Bird 43 Wattmeter, or equivalent

JFW 50T-032-1:1 Dummy Load (100 W), or equivalent

MDT

9.7.6.2 Procedure for Setting the Lower Power Limit.-

1. If the radio is to be used in the Remote Tuning Mode, connect the equipment as shown in Figure 9-20. If the radio is to be used in the Fixed Tuning Mode, connect the equipment as shown in Figure 9-21.

NOTE

When using a transmitter/transmitter configuration, the standby transmitter must be cabled to the main transmitter ATR. Refer to Figure 1-8 for cabling diagram.

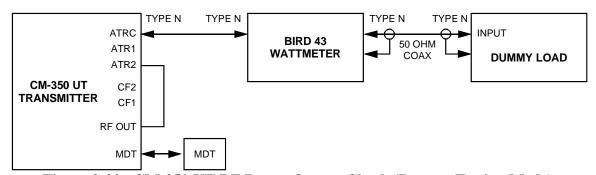


Figure 9-20. CM-350 UT RF Power Output Check (Remote Tuning Mode)

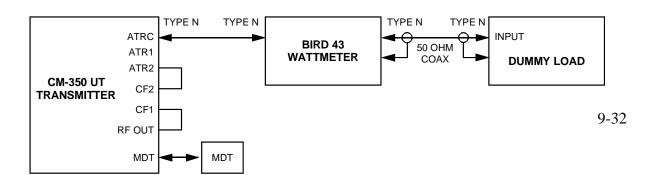


Figure 9-21. CM-350 UT RF Power Output Check (Fixed Tuning Mode)

- 2. Ensure the radio is set to the proper RF Tuning Mode using the MDT (see Section 10.6.5.4.2).
- 3. Set the Lower Power Limit threshold using the following procedures
 - a. Connect the MDT (see Section 10.3) and access the CM-300 UT Detail Window (see Section 10.6.4.3).
 - b. If an Output Power Alert is not desired, then enter 000 for the Lower Power Limit and click the Apply button. Skip to section 9.7.6.3.
 - c. In the Front Panel tab, change the Power Level (see Section 10.6.5.4.8) to the desired output level (from Figure 9-22 for Remote Tuning Mode or Figure 9-23 for Fixed Tuning Mode) at which you would like to receive an Output Power Alert.

NOTE

Radios have a factory-set maximum power level and will not allow values above this limit. This limit is frequency dependent and also will change depending on the RF Tuning Mode (Remote/Fixed).

- d. Click on the Apply button to apply all changes to the MDT.
- e. Key the transmitter (see Section 10.6.5.4.12).
- f. While monitoring the wattmeter, increase or decrease the Power Level setting (see Section 10.6.5.4.8) to meet the desired output level (from Figure 9-22 or Figure 9-23) at which you would like to receive an Output Power Alert.
- g. Click on the Apply button to apply all changes to the MDT.
- h. In the Front Panel tab, starting at 0, increase the Lower Power Limit (see Section 10.6.5.4.9) in increments of 5 then apply the changes by clicking the Apply button. Continue until an Alert is indicated on the radio. The Alert should be verified as an Output Power Alert in the Summary Fault Status Window (see Section 10.6.5.4.4).
- i. Unkey the transmitter (see Section 10.6.5.4.12).

9.7.6.3 Procedure for Setting the RF Power Output.-

- 1. Using Figure 9-22 for Remote Tuning Mode or Figure 9-23 for Fixed Tuning Mode, as a guide, change the Power Level (see Section 10.6.5.4.8) to the desired RF Power Output level.
- 2. Key the transmitter using the MDT (see Section 10.6.5.4.12).
- 3. Measure the transmitter output power. If power out does not meet the requirements, adjust using the following procedure:
 - a. While monitoring the wattmeter, increase or decrease the power setting by clicking on the up or down arrows to the right side of the Power Level (see Section 10.6.5.4.8).
 - b. Click on the Apply button to apply all changes to the MDT.
 - c. Continue to repeat steps a and b until the power output meets requirements.
- 4. Unkey the transmitter using the MDT (see Section 10.6.5.4.12).

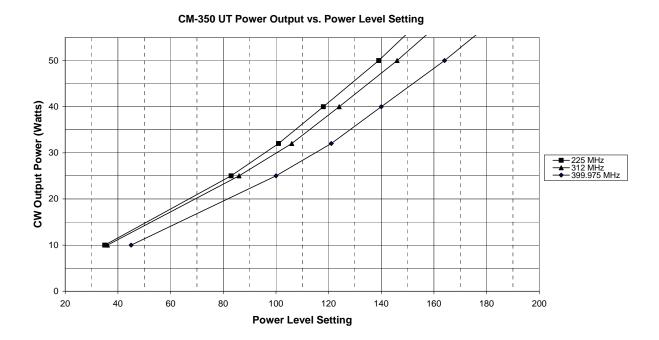


Figure 9-22. CM-350 UT Power Output Vs Power Level Setting (Remote Tuning Mode)

NOTE

The graph for the setting above is approximate. External test equipment should be used to verify the setting.

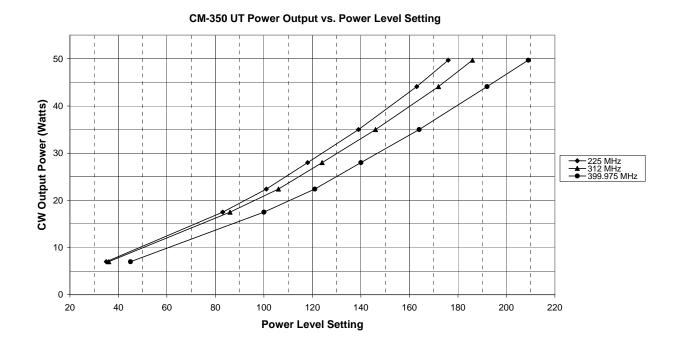


Figure 9-23. CM-350 UT Power Output Vs Power Level Setting (Fixed Tuning Mode)

The graph for the setting above is approximate. External test equipment should be used to verify the setting.

9.7.7 Check CM-350 UT Modulation Level and Set the Modulation Limiter Level (Remote/Fixed).- The purpose of this section is to provide procedures to set the modulation limiter level and to measure and adjust the percent of modulation. The Modulation Limiter Level should be set first. A graph that shows the approximate Modulation Limiter Level setting to achieve limiting at a specific percent modulation level is included in Figure 9-26. The modulation limiter circuit will limit the audio signal in order to prevent the radio from overmodulating. The Modulation Limiter Level should be set such that limiting will begin at the desired modulation percentage plus 5% (i.e. if you want a modulation percentage of 90% then you would set up the Mod Limit Level to begin limiting the audio when the modulation percentage reaches 95%.). After the limiter level is set, you then proceed to set up your desired modulation percentage by changing the Mod Index Level. A graph that shows the approximate modulation index level setting to achieve the desired percent modulation level is included in Figure 9-27.

NOTE

The modulation limiter level and the modulation index level are highly dependent upon the operating frequency and the output power level. In order to ensure the radio is set up correctly the following sequence should be used when modifying any of these parameters.

- 1. Set operating frequency (see Section 9.7.2).
- 2. Tune cavity filter if in Fixed Tuning Mode (see Section 9.6.5).
- 3. Set output power level (see Section 9.7.6).
- 4. Set modulation limiter level (see Section 9.7.7.2).
- 5. Set modulation index level (see Section 9.7.7.3).

9.7.7.1 Test Equipment.-

- Agilent 8901 Modulation Analyzer, or equivalent
- Agilent 8903 Audio Analyzer, or equivalent
- Agilent 8904 Function Generator, or equivalent
- Tektronix 465 Oscilloscope, or equivalent
- M85/U carbon microphone, or equivalent
- JFW 50 FH-020-100 20 dB Attenuator, or equivalent
- MDT

9.7.7.2 Procedure for setting the Modulation Limiter Level (Remote/Fixed).-

- 1. Set front panel controls on Audio Analyzer to measure the audio level in dBm.
- 2. Use the Audio Analyzer to set the Function Generator for 1 kHz sine wave of -8 dBm into a 600 ohm balanced load.
- 3. If the radio is to be used in the Remote Tuning Mode, connect the equipment as shown in Figure 9-24. If the radio is to be used in the Fixed Tuning Mode, connect the equipment as shown in Figure 9-25.

NOTE

When using a transmitter/transmitter configuration, the standby transmitter must be cabled to the main transmitter ATR. Refer to Figure 1-8 for cabling diagram.

- 4. Ensure the radio is set to the proper RF Tuning Mode (Remote or Fixed) using the MDT (see Section 10.6.5.4.2).
- 5. Set the Modulation Limiter Level
 - a. Using either the Fixed or Remote Tuning curve from Figure 9-26 as a guide, set the Mod Limiter Level (see Section 10.6.5.4.7) to the setting that corresponds with the desired modulation percentage at which the limiting circuit will activate to prevent overmodulation of the RF signal.
 - b. Click on the Apply button to apply all changes to the MDT.
 - c. Change the Modulation Index Level to 255 by clicking on the up arrow to the right side of the Mod Index Level (see Section 10.6.5.4.6).
 - d. Click on the Apply button to apply all changes to the MDT.
 - e. Use the MDT to key the radio (see Section 10.6.5.4.12).
 - f. While monitoring the Modulation Analyzer, increase or decrease the Mod Limiter Level by clicking on the arrows to the right side of the Mod Limiter Level, followed by clicking on the Apply button, until the modulation percentage is at the desired modulation limiter level (see Section 10.6.5.4.7).

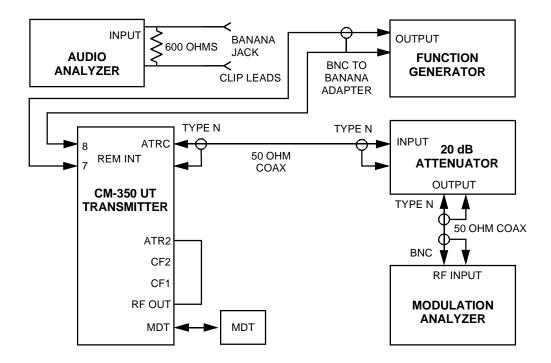


Figure 9-24. CM-350 UT Modulation Level Check (Remote Tuning Mode)

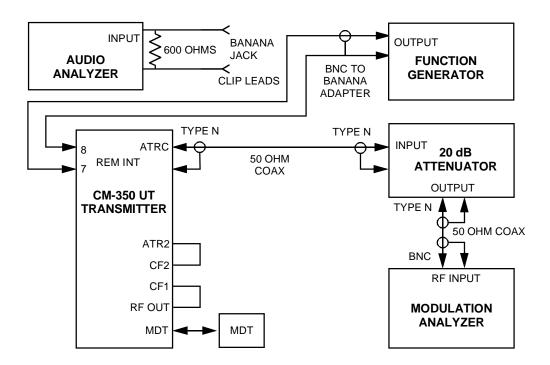


Figure 9-25. CM-350 UT Modulation Level Check (Fixed Tuning Mode)

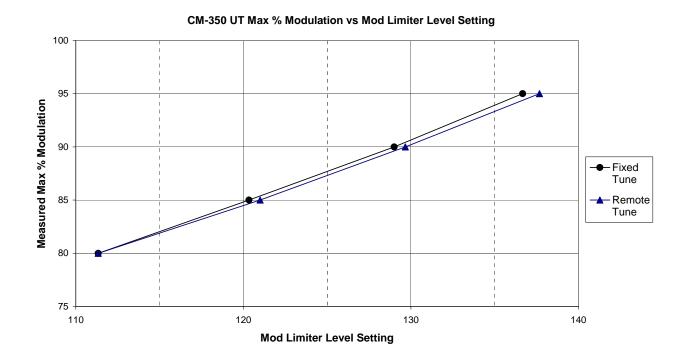


Figure 9-26. CM-350 UT Max % Modulation Vs Mod Limiter Level Setting

The graph for the setting above is approximate. External test equipment should be used to verify the setting.

9.7.7.3 Procedure for setting the Modulation Index Level.-

- 1. Using either the Fixed or Remote Tuning curve from Figure 9-27 as a guide, set the Mod Index Level to the setting that corresponds with the desired modulation percentage (see Section 10.6.5.4.6).
- 2. Measure the modulation percentage. If the percentage does not meet the requirements, then adjust using the following procedure.
 - a. In the Front Panel tab, while monitoring the Modulation Analyzer, set the Modulation Index Level by clicking on the arrows to the right side of the Mod Index Level, followed by clicking on the Apply button, until the modulation percentage is at the desired level (see Section 10.6.5.4.6).
 - b. Unkey Transmitter using the MDT (see Section 10.6.5.4.12).
- 3. Perform a test count through the front panel microphone jack. Observe the oscilloscope for voice peaks not to exceed the standards and tolerances.

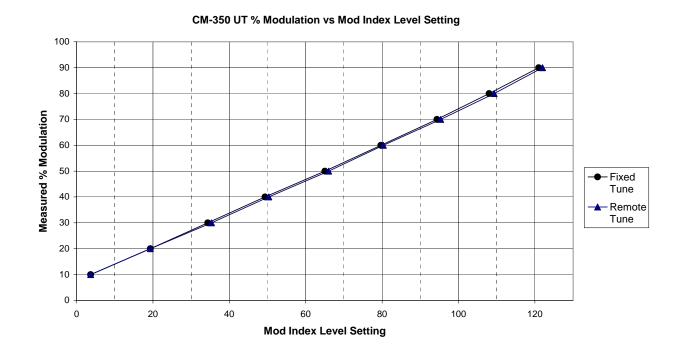


Figure 9-27. CM-350 UT % Modulation Vs Mod Index Level Setting

 NOTE

The graph for the setting above is approximate. External test equipment should be used to verify the setting.

- 9.7.8 Set CM-350 UT ATR Relay (Remote/Fixed).- There are 3 modes available: Normal, ATR1, or ATR2. Normal mode is Regular Push To Talk (PTT) control. ATR1 and ATR2 modes are intended for maintenance purposes only (see Section 10.6.5.4.11). The ATR is factory-set at Normal and should remain at that position for normal operations.
- 9.7.9 Set CM-350 UT Transmitter Timeout. This procedure will set the Tx Timeout in seconds. If the radio is transmitting and reaches this limit, it will return to receive mode and generate an Alert message. Factory default is at 35 seconds. This procedure is performed through the MDT (see Section 10.6.5.4.10).

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SECTION 10 SOFTWARE

- <u>10.1 INTRODUCTION</u>.- This section defines minimum system requirements for the MDT and describes the installation and operation of the UHF MDT Software.
- <u>10.2 MINIMUM SYSTEM REQUIREMENTS</u>.- The MDT interface software can operate on industry standard laptop Personal Computers that, at a minimum, are configured with the following:
 - 1) Windows 2000 or Windows NT Service Pack 6.0
 - 2) 100 Mb of Hard Drive space for MDT software exclusive use
 - 3) 32 Mb of RAM
 - 4) 800x600x8 display
 - 5) Pentium 200 processor
 - 6) RS-232 serial interface using DB-9 connector
 - 7) CD-ROM Drive
 - 8) Single Standard High Density Floppy drive
- 10.3 MDT TO RADIO CONNECTION. Connect the MDT to the radio front or rear panel MDT connectors (while the radio is installed in the rack, the front MDT connector may be more accessible). If the connector on the MDT cable is not compatible with the mating connector on the transmitter, assemble the new connector and back shell (supplied with the transmitter). Follow the assembly instructions in Section 9.3.5.
- <u>10.4 UHF MDT SOFTWARE INSTALLATION.</u> The UHF MDT Software is available on CD ROM. See Table 1-5 for part number and NSN. For installation and initialization of the UHF MDT Software, follow the procedure below.

NOTE

The LongArm® Lite / CM-300 Radio Series Application software is referred to as the "UHF MDT Software" or just the "CM-300 Radio Series Application".

- 1. Insert the UHF MDT Software CD into the MDT CD drive. Installation should commence automatically.
- 2. If not, access the CD drive and double-click on Setup.exe file (Figure 10-1). This will run the Setup application.

NOTE

If this is the first installation, the first screen displayed is the Welcome to the InstallShield Wizard LongArm® Lite / CM-300 Radio Series window (Figure 10-6). Go to step 4.

If a previous version of the UHF MDT Software was installed, the first screen displayed is the Welcome window (Figure 10-2). Go to step 3 to uninstall the previous version, repeat step 2, and then go to step 4.

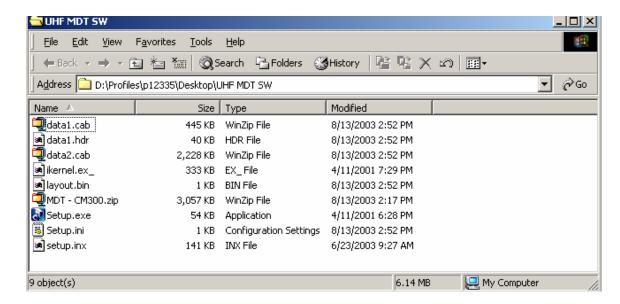


Figure 10-1. UHF MDT Software Setup Files

- 3. Uninstall previous version of the UHF MDT Software as follows:
 - a. On the Welcome window (Figure 10-2) select the Remove button and click Next. The Confirm File Deletion dialog box is displayed.



Figure 10-2. Welcome, Window

b. On the Confirm File Deletion dialog box (Figure 10-3), click OK. The ReadOnly File Detected dialog box is displayed.



Figure 10-3. Confirm File Deletion, Dialog Box

c. On the ReadOnly File Detected dialog box (Figure 10-4), click Yes. The Maintenance Complete window is displayed.

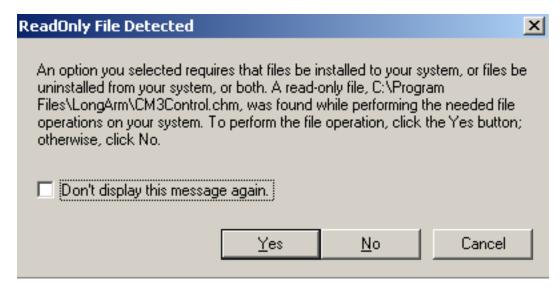


Figure 10-4. Confirm ReadOnly File Deletion, Dialog Box

d. On the Maintenance Complete window (Figure 10-5), click Finish. This will complete the deinstallation.

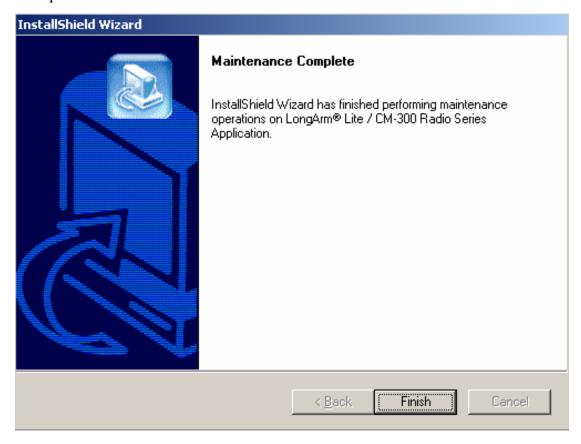


Figure 10-5. Maintenance Complete, Window

e. Go back to step 2 and double-click on Setup.exe. The Welcome to the InstallShield Wizard LongArm® Lite / CM-300 Radio Series window is displayed (Figure 10-6).

4. The InstallShield Wizard LongArm® Lite / CM-300 Radio Series window (Figure 10-6) is the Installation Wizard for CM-300 Radio Series Applications. Click on Next to proceed with the installation. The Choose Destination Location window is displayed.



Figure 10-6. InstallShield Wizard for CM-300 Radio Series, Window

5. On the Choose Destination Location window (Figure 10-7), click on Next. The Select Program Folder window is displayed.



Figure 10-7. Choose Destination Location, Window

6. On the Select Program Folder window (Figure 10-8), click on Next. The Start Copying Files window is displayed.



Figure 10-8. Select Program Folder, Window

7. On the Start Copying Files window (Figure 10-9), click on Next. The files are copied to the location specified in step 5 and the InstallShield Wizard Complete window is displayed.

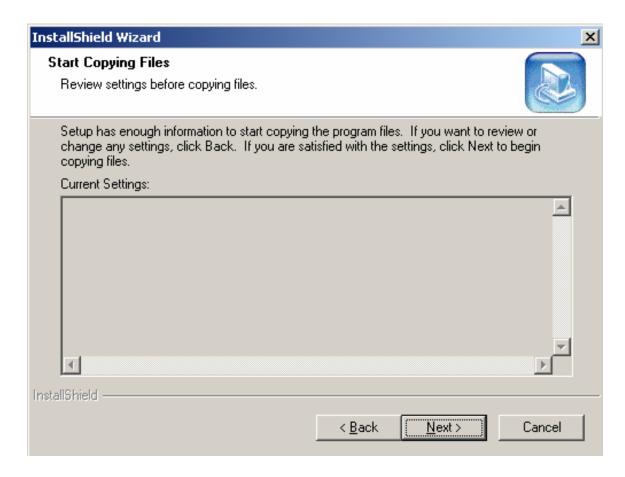


Figure 10-9. Start Copying Files, Window

8. On the InstallShield Wizard Complete window (Figure 10-10), click on Finish. The installation is completed and the CM-300 Radio Series Setup window is displayed. A Readme.txt-Notepad is also displayed providing instructions for using the basic features of the CM-300 Radio Series Application Software.



Figure 10-10. InstallShield Wizard Complete, Window

NOTE

Once the installation is complete, the CM-300 Radio Series Application Software files are stored in the location specified in step 5 (Figure 10-11). Executing the **CM3Setup.exe** application will open the CM-300 Radio Series Setup window (Figure 10-12). Executing the **CM3Control.exe** application will open the Radio Control window (Figure 10-17). However, normal access to the software will usually be done through the Start menu (see Section 10.5)

CM3Setup.exe	276 KB	Application	7/30/2003 12:51 PM
CM3Control.exe	436 KB	Application	7/30/2003 12:51 PM
N DVMSG005.dll	44 KB	Application Extension	7/30/2003 12:49 PM
N DvLogMsg.dll	44 KB	Application Extension	7/30/2003 12:49 PM
N LACmnDLL.dll	100 KB	Application Extension	7/30/2003 12:48 PM
N LATree.dll	56 KB	Application Extension	10/10/2002 10:45 AM
RadioControl.chm	260 KB	Compiled HTML Help	9/13/2002 5:32 PM
N LAENGMSG.dll	32 KB	Application Extension	8/20/2002 11:22 AM
DEVMSG.dll	24 KB	Application Extension	8/20/2002 11:22 AM
Readme.txt	2 KB	Text Document	6/21/2002 10:57 AM
	44 KB	Help File	8/6/1998 3:05 PM
DEFAULT.MDM	1 KB	MDM File	9/8/1997 4:34 PM
N DTBL32.DLL	341 KB	Application Extension	11/5/1996 7:45 AM

Figure 10-11. CM-300 Radio Series Application Software Files

<u>10.5 ACCESSING THE UHF MDT SOFTWARE</u>.- After the UHF MDT Software has been installed, it can be accessed through the Start menu:

Start/Programs/LongArm/ CM-300 Radio Series Setup

Create a shortcut on the desktop:

- 1. Right-click on CM-300 Radio Series Setup and select Create Shortcut
- 2. Drag and drop the created shortcut to your desktop

On the **CM-300 Radio Series Setup** window, select the transmitter from the Radio Type box (see Section 10.6.1).

10.6 UHF MDT SOFTWARE OPERATION. The UHF MDT Software facilitates the CM-300 Radio Series Graphic User Interface (GUI). The GUI provides the user interface necessary to control and monitor the CM-300 UHF receiver, the CM-300 UHF transmitter and CM-350 UHF transmitter. The CM-300 Radio Series GUI consists of the:

• CM-300 Radio Series Setup window (used to configure each radio) and the

• CM-300 Detail window (used to monitor/control each radio)

<u>10.6.1 CM-300 Radio Series Setup Window</u> - This window is used as a configuration dialog for all CM-300 series radio types. The CM-300 Radio Series Setup window is shown in Figure 10-12 and its controls are described in Table 10-1. Detailed descriptions of operational procedures are provided in Section 10.6.2.

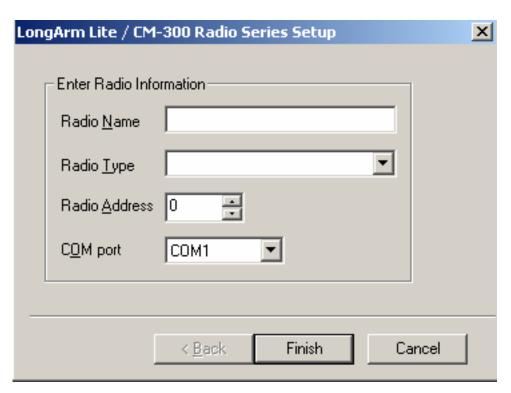


Figure 10-12. CM-300 Radio Series Setup, Window

Table 10-1. CM-300 Radio Series Setup Window Controls

Name	Limits	Control	Execution	Description
Radio Name	25 Alphanumeric characters	Edit box	Selection of Finish	Enter the name of the radio here.
Radio Type	"CM-300 UHF Receiver", "CM-300 UHF Transmitter", or "CM-350 UHF Transmitter"	Drop-down list box	Selection of Finish	Enter the radio type here.
Radio Address	"0" to "15"	Edit box and spin control	Selection of Finish	Enter the radio address here. Must be the correct address or radio may not be accessed. Currently default address is 15 as only one radio is configured per MDT.
COM Port	All available COM ports	Drop-down list box	Selection of Finish	Select a COM port here. This depends on how many ports are available on the user's PC and which port is being used.
Back	N/A	Button	Immediate	Go to previous page. This button is always disabled as only one radio is configured per MDT.
Finish	N/A	Button	Immediate	Apply changes.
Cancel	N/A	Button	Immediate	Discard changes and exit dialog.

10.6.2 CM-300 Radio Series Setup Window Operation. This window is used to configure the radio which is to be monitored/controlled. It sets the radio name, radio type, radio address, and COM port. It generates a unique identity for each radio, enabling the operator to call up the required radio as needed. The procedures to do this are described below.

NOTE

Currently, only one radio is configured per MDT. The same procedures may be used for either a CM-300 UHF Receiver, a CM-300 UHF Transmitter, or a CM-350 UHF Transmitter.

1. Set Radio Name - On the CM-300 Radio Series Setup window, in the Radio Name field, enter the radio name. This entry may be as many as 25 alpha-numeric characters long e.g. CM-300 UR, or CM-300 UT, or CM-350 UT (Figure 10-13).

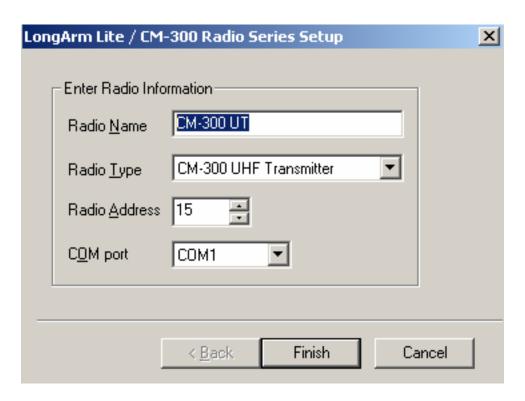


Figure 10-13. Set Radio Name, Screen

2. Set Radio Type - On the CM-300 Radio Series Setup window, click on the down arrow of the Radio Type pulldown list and select CM-300 UHF Receiver, or CM-300 UHF Transmitter, or CM-350 UHF Transmitter (Figure 10-14).

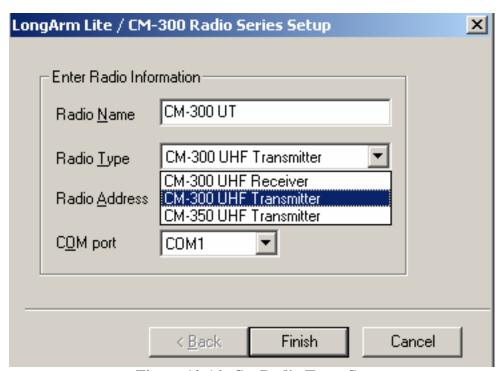


Figure 10-14. Set Radio Type, Screen

3. Set Radio Address - On the CM-300 Radio Series Setup window, use up/down arrows to select address 15 (Figure 10-15).

NOTE

It is important that the correct address is entered. If the correct address is not entered, the MDT will be unable to access the radio. The radio address of each radio is hardwired at the REM INT connector and it can be a number from 0 through 15. However, currently, only one radio is configured per MDT and the default address setting at the REM INT connector is 15 (see section 9.6.1).

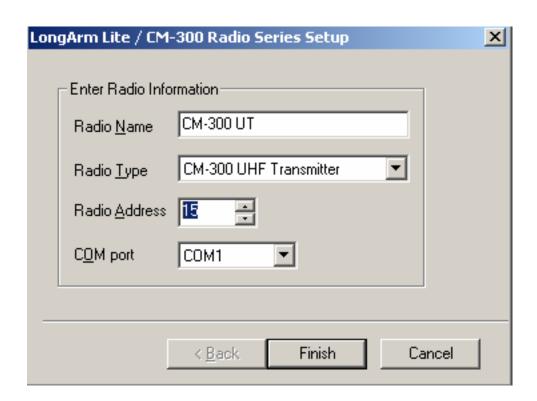


Figure 10-15. Set Radio Address, Screen

4. Select a COM Port - On the CM-300 Radio Series Setup window, click on the down arrow of the COM port pulldown list and select port (Figure 10-16).

NOTE

It is important that the correct COM port is entered. If the correct COM port is not entered, the MDT will be unable to access the radio. This depends on how many ports are available on the user's MDT and which port is being used.

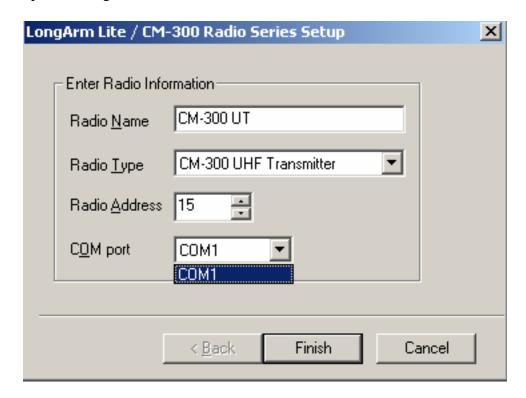


Figure 10-16. Set COM Port, Screen

- 5. Click on Finish to apply all the settings. This will complete the radio setup process and will display the Radio Control window (Figure 10-17) for the radio that has been configured. i.e. for CM-300 UHF Receiver, or CM-300 UHF Transmitter, or CM-350 UHF Transmitter. This window will have a title of "Default.rcg Radio Control (Lite)"
- 6. Save settings for each radio configured by doing a "Save As" in the Radio Control window displayed.
 - a. Pull down the File menu, select Save As.
 - b. In the Save As dialog box, enter the desired file name e.g. CM-300 UT. This will rename the Radio Control window from "Default.rcg Radio Control (Lite)" to "CM-300 UT.rcg Radio Control (Lite)".

10.6.3 CM-300 Radio Series Radio Control Window. The Radio Control window is displayed after configuration has been completed (see Section 10.6.2). The Radio Control application is used to monitor and control the radios' "common" fields. These fields are: Frequency, Channel, Mode, Power State, Squelch, AGC, Gain, BW, Alternate Frequency Band (AFB), Tx Power Level, Status, and Owner. For the CM-300 UR, only Frequency and Squelch are available. For the CM-300 UT and CM-350 UT radios, only Frequency and Tx Power Level are available. The CM-300 Radio Series Radio Control window is shown in Figure 10-17, and its controls are described in Table 10-2.

The Radio Control screen currently has limited application, but will be further utilized in future enhancements. The software is based on the LongArm software and includes the same structure, much of which is not utilized.

The parameters that are shown on this screen can be changed. Either right-click on the parameter or left-click and hit the ENTER key to change the parameter. If the device does not support frequency, channel, mode, power, squelch, AGC, Gain, BW, AFB, or Tx Pwr, the corresponding cell for that device is left blank. The dialog will not pop-up when user right-clicks or selects and presses Enter on the cell. The user can collapse the non-supported cells.

The Detail window is invoked from the Radio Control window in several ways (see Section 10.6.4.3).

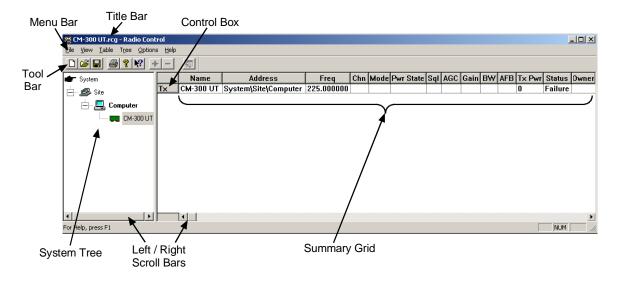


Figure 10-17. CM-300 Radio Series Radio Control, Window

Table 10-2. CM-300 Radio Series Radio Control Window Controls

	Cont	rol	Description
Menu Bar	File	New	Creates a new .rcg file.
		Open	Opens an existing .rcg file.
		Save	Saves configuration to existing .rcg file.
		Save As	Save configuration to a user-defined .rcg file.
		Print	Prints the Name, Address, Frequency, and Status of monitored radio.
		Print Setup	For future use.
		Exit	Exit MDT software.
	View	Toolbar	Shows/Hides the shortcut icons near top of screen.
		Status Bar	Shows/Hides the status bar at bottom of screen.
		Split	Allows for sizing adjustments to the two portions of the screen.
		Detail Page	Opens Detail window for the radio selected; same function as Detail Page icon. To activate this control, select the radio icon on the System Tree or select the Summary Grid.
	Table	No Sort	For future use.
		Ascending Sort	For future use.
		Descending Sort	For future use.
		Sort by	For future use.
	Tree	Add Radio to Grid	For future use. To activate this control, select the radio icon on the System Tree.
	Options	Set Font	Changes font characteristics.
		Save Settings on Exit	Enable/Disable saving settings on exit.
		Save Settings Now	Save settings now.

Table 10-2. CM-300 Radio Series Radio Control Window Controls (Contd)

	Cont	rol	Description
Menu Bar (Contd)	Help	Contents	Guide to using the LongArm Lite / CM-300 Series Radio Application.
		About Radio Control	Version and copyright information.
Tool Bar			arsor over the icon to display its name. These ality of the controls in the Menu Bar.
	New		Creates a new .rcg file.
	Open		Opens an existing .rcg file.
	Save		Saves configuration to existing .rcg file.
	Print		Prints the Name, Address, Frequency, and Status of monitored radio.
	About		Version and copyright information.
	Help		Guide to using the LongArm Lite / CM-300 Series Radio Application.
	Add Row		Adds Summary Grid row. To activate this icon, select the radio on the System Tree.
	Delete Row		Deletes Summary Grid row. To activate this icon, click on the Control Box to select the Summary Grid.
	Detail Page		Opens Detail window for the radio selected. To activate this icon, select the radio on the System Tree or select the Summary Grid.
Control Box			Selects Summary Grid.

10.6.4 CM-300 Radio Series Radio Control Window Operation. The Radio Control window is the first screen invoked for the monitoring and control of a radio. It displays the system tree, the name of the radio, the frequency and transmitter power settings, and the status of the radio. From this screen, you may edit the frequency and transmitter power settings or invoke the radio's Detail Window.

<u>10.6.4.1 Set Operating Frequency Using the Radio Control Window</u>.- This procedure sets the radio's operating frequency.

NOTE

The operating frequency may also be set through the Detail Window Front Panel Tab (see Section 10.6.5.4.1).

- 1. On the Radio Control window, right-click on the Freq cell or select the Freq cell and press Enter. The Frequency [MHz] dialog box is displayed (Figure 10-18).
- 2. On the Frequency [MHz] dialog box, set frequency as required.
- 3. Click on OK to apply the change.

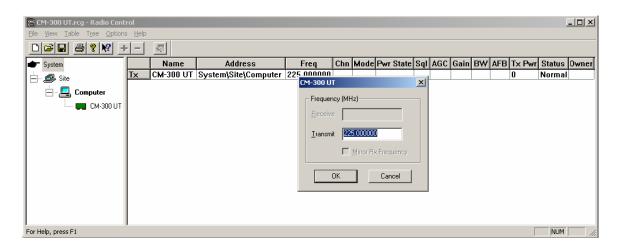


Figure 10-18. Radio Control Window – Frequency Dialog Box

<u>10.6.4.2 Set Transmitter Power Using the Radio Control Window</u>.- This procedure sets the transmitter power level.

NOTE

The transmitter power level may also be set through the Detail Window Front Panel Tab (see Section 10.6.5.4.8).

- 1. On the Radio Control window, right-click on the Tx Pwr cell or select the Tx Pwr cell and press Enter. The Tx Pwr dialog box is displayed (Figure 10-19).
- 2. On the Tx Pwr dialog box, use up and down arrows to select Tx Pwr setting.

3. Click on OK to apply the change.

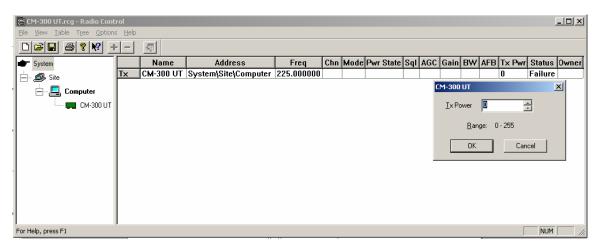


Figure 10-19. Radio Control Window - Tx Power Dialog Box

<u>10.6.4.3 Invoke CM-300 UT/CM-350 UT Detail Window.</u> Detailed monitoring and control of radios is facilitated by the radio's Detail Window (see Section 10.6.5). This window can be invoked from the Radio Control window in several ways:

- Double-click anywhere in the Summary Grid.
- Click on the radio icon to highlight the radio in the System Tree. Click on the Detail Page icon in the tool bar, or select View then Detail Page in the menu bar.
- Click on the Control Box to the left of the radio's row to highlight the radio's Summary Grid. Click on the Detail Page icon in the tool bar or select View, then Detail Page in the menu bar.

<u>10.6.5 CM-300 UT/CM-350 UT Detail Window.</u> Detailed monitoring and control of radios is done from the CM-300 UT/CM-350 UT Detail window. This window is invoked via the Radio Control application (see Section 10.6.4.3).

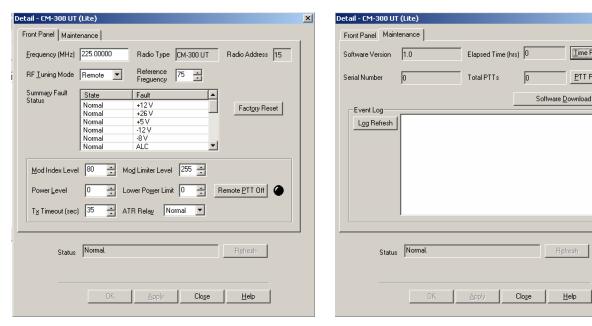
The CM-300 UT/CM-350 UT Detail window contains two tabs (Figure 10-20):

- Front Panel tab
- Maintenance tab

Time Refresh

PTT Refresh

<u>H</u>elp



Front Panel Tab Maintenance Tab

Figure 10-20. Front Panel Tab and Maintenance Tab

10.6.5.1 CM-300 UT/CM-350 UT Detail Window Common Controls. The following controls are common to both the Front Panel and Maintenance tabs. Their operation is described first. See Tables 10-3 and 10-4, and Section 10.6.5.2.

Table 10-3. Common Controls Functionality

Control	Function
Status	Same for both the Front Panel tab and Maintenance tab.
Refresh, OK, Apply	Activated only in Editing Mode. Deactivated in Maintenance tab
	unless Editing Mode is entered through the Front Panel tab.
Close	Same for both the Front Panel tab and Maintenance tab.
Help	Same for both the Front Panel tab and Maintenance tab.
Editing Mode	Can only be entered through the Front Panel tab. Activates Refresh,
	OK, and Apply.
Queuing Device Mode	Same for both the Front Panel tab and Maintenance tab.
Changes Pending Mode	Same for both the Front Panel tab and Maintenance tab.

Table 10-4. CM-300 UT/CM-350 UT Detail Window Common Controls

Name	Limits	Control	Execution	Description
Status	Text	Static text control	N/A	Current status of radio. This will reflect the most critical status reported in the Summary Fault Status list. This status is also displayed in the Radio Control window. Currently the following statuses are displayed:
				"Normal." – MDT is able to communicate with radio and the highest Alarm/Alert state is "Normal".
				"Alert." – MDT is able to communicate with radio and the highest Alarm/Alert state is "Alert".
				"Alarm." – MDT is able to communicate with radio and the highest Alarm/Alert state is "Alarm".
				"Failure." – MDT is able to communicate with radio and the highest Alarm/Alert state is "Failure".
				"Failed." – MDT is unable to communicate with radio.
				"Initializing." – MDT is busy querying radio for its parameters. This status will be displayed when the radio is configured for the very first time and when status changes from "Failed".
				"Downloading software." – MDT is busy downloading software to the radio.
Refresh	N/A	Button	Immediate	Enabled only when in "Editing Mode" and new radio settings are received.
				Refresh radio settings. When the Refresh button is clicked, a confirmation dialog is displayed. Click Yes - All changes will be lost and radio settings, as of the last Apply, will be restored. Click No - Changes will not be lost and may continue editing radio settings.
OK	N/A	Button	Immediate	Enabled only when in "Editing Mode".
				Apply radio settings then close dialog. Click on the OK button to apply all changed radio parameters to the MDT. All controls but the Close and the Help button will be grayed out while the GUI is waiting for the response from the MDT. The detail dialog will close upon receiving a successful response from the MDT. Essentially, the OK button is a combination of the Apply and Close buttons.
				Error checking is applied when the OK button is clicked.

Table 10-4. CM-300 UT/CM-350 UT Detail Window Common Controls (Contd)

Name	Limits	Control	Execution	Description
Apply	N/A	Button	Immediate	Enabled only when in "Editing Mode".
				Apply all changed radio parameters to the radio. All controls but the Close button will be grayed out while the GUI is waiting for the response from the radio. The detail dialog will not close upon receiving a successful response from the driver.
				Error checking is applied when the Apply button is clicked.
Close	N/A	Button	Immediate	In the editing mode, when the Close button is clicked on, a confirmation dialog is displayed.
				Click Yes - Discard all changes and close dialog
				Click No - Return to detail dialog
				If not in the editing mode, the detail window closes immediately when the Close button is clicked on.
Help	N/A	Button	Immediate	Display help for detail page.
	this area wh	enever the D		oply button, is the Detail Page mode indicator. Text is in a special mode. The following is a description of the
Querying Device:	N/A	Display	N/A	When the detail page is first opened, it sends query messages to the radio asking for current radio parameters. While waiting for responses from the radio, all controls but the Close button are grayed out. Once responses are received, radio parameters are displayed and the detail page goes out of this mode.
Editing Mode:	N/A	Display	N/A	The detail page goes into editing mode whenever the user begins entering in new values for the radio parameters. When the detail page goes into this mode, the Apply and OK buttons are enabled so the user can "apply" the changes.
Changes Pending:	N/A	Display	N/A	The detail page goes into this mode when the Apply button is clicked. This is an indication that the detail page is waiting for responses from the MDT while it is applying changes to the radio. While in this mode, all controls but the Close button are grayed out.

10.6.5.2 CM-300 UT/CM-350 UT Detail Window Common Controls Operation. This section provides detailed descriptions for procedures that may be executed using the CM-300 UT/CM-350 UT Detail window common controls. These procedures are the same for both the Front Panel tab and the Maintenance tab. The following procedures are provided:

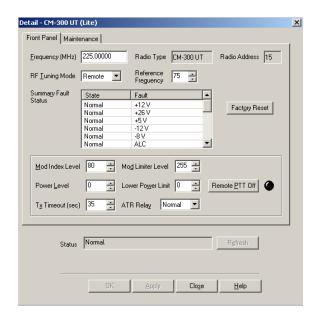
- Enter Editing Mode
- Apply Changed Radio Parameters to the MDT
- Refresh Radio Settings

<u>10.6.5.2.1</u> Enter Editing Mode.- This procedure provides instructions on how to enter the editing mode and proceed to monitor/control radio parameters.

NOTE

In the Maintenance tab, the Refresh, OK, and Apply buttons are normally grayed out. The editing mode can only be entered through the Front Panel tab.

- 1. On the CM-300 UT/CM-350 UT Detail window, open the Front Panel tab.
- 2. Before you start entering data, the Front Panel tab will display the factory default settings or the latest settings (since the last Apply). The Refresh, OK, and Apply buttons will be deactivated (grayed out). See Figure 10-21.
- 3. Begin to enter data (e.g. change the RF Tuning Mode).
- 4. The Refresh, OK, and Apply buttons are activated and Editing Mode is displayed just below the Apply button (Figure 10-21).



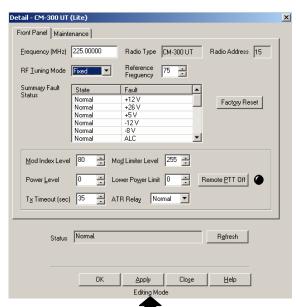


Figure 10-21. Enter Editing Mode, Screen

10.6.5.2.2 Apply Changed Radio Parameters to the MDT. This is the process by which new radio parameters are applied to the MDT. In this procedure, either the Apply button or the OK button may be used. If the Apply button is used, the detail dialog will not close upon receiving a successful response from the MDT. If the OK button is used, the detail dialog will close upon receiving a successful response from the MDT (a combination of Apply and Close).

NOTE

Error checking is applied when the OK or Apply button is clicked. There is minimal error checking when each input field is being edited. For example, input fields that require numerical values will not accept alpha characters. Input values are then validated against actual ranges/limits when they are about to be applied to the MDT.

When using the UHF MDT Software to make changes to the radio parameters, change one parameter at a time. Click on Apply (or OK) to apply the change before proceeding with further changes.

- 1. In the Front Panel tab, enter desired changes.
- 2. Click on Apply (or OK).
- 3. All controls but the Close button will be grayed out (if OK is used, all controls but the Close and Help buttons will be grayed out). The Changes Pending mode is displayed just below the Apply button (Figure 10-22).
- 4. The Changes Pending mode will remain in effect until a successful response from the MDT is received.
- 5. If a successful response from the MDT is received, the Front Panel dialog will be reactivated (if the OK button is used, the Front Panel dialog will be closed).
- 6. If the operation is not successful, an error message is displayed.
- 7. On the Error dialog box, Click OK to return to the Front Panel tab.

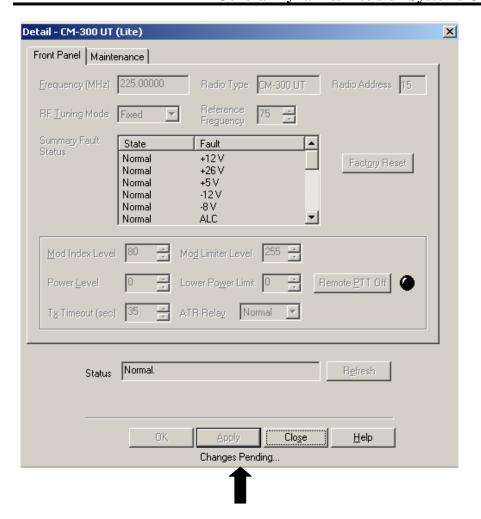




Figure 10-22. Apply Changes to the MDT, Screens

<u>10.6.5.2.3</u> Refresh Radio Settings.- This procedure restores the radio settings to the last settings applied. This is enabled only in the Editing Mode.

- 1. In the Front Panel tab, while in the Editing Mode, click on the Refresh button.
- 2. A dialogue box will appear stating that all changes will be lost and asking if you wish to continue (Figure 10-23). Click on Yes. (Clicking on No will abort the Refresh and return to Editing Mode).
- 3. The Front Panel settings will be restored to the last settings applied. i.e. all settings entered during the current editing session will be lost.



Figure 10-23. Refresh Radio Settings Confirmation, Screen

<u>10.6.5.3 Front Panel Tab.</u>- A sample CM-300 UT/CM-350 UT Detail window Front Panel tab is shown in Figure 10-24. The Front Panel tab controls are described in Table 10-5. Detailed descriptions of operational procedures are provided in Section 10.6.5.4.

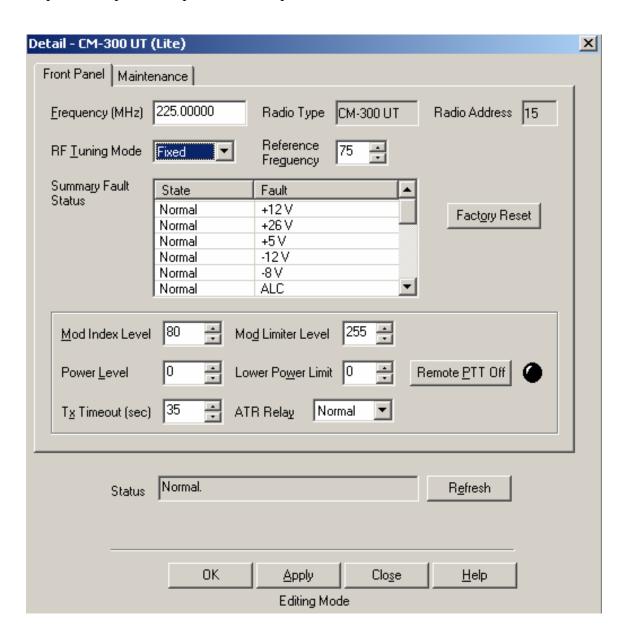


Figure 10-24. Front Panel Tab

Table 10-5. Front Panel Tab Controls

Name	Limits	Control	Execution	Description
Frequency (MHz)	225.000 to 399.975	Edit box	Selection of Apply	Transmitter operating frequency. 225.000 to 399.975 MHz range (in 0.025 MHz increments). Values outside this range will not be accepted. Factory default is at 225.000 MHz.
Radio Type	"CM-300 UR", "CM- 300 UT", or "CM- 350 UT"	Static text control	N/A	Display radio type. The radio type is defined during Setup (see 10.6.2). It may be a CM-300 UR, or a CM-300 UT, or CM-350 UT.
Radio Address	0 to 15	Static text control	N/A	Display radio address. Factory default is at 15. The radio address is defined during Setup (see 10.6.2).
RF Tuning Mode	"Fixed" or "Remote"	Drop- down list box	Selection of Apply	"Fixed" tuning mode should be selected when a cavity filter is being used with the radio. This setting allows a higher maximum output power level at a given frequency to be entered in order to overcome the losses through the cavity filter. "Remote" tuning mode should be selected when a cavity filter will not be used with the radio. This will limit the power level setting on the radio to ensure that it does not exceed the factory set maximum output power at a given frequency. Factory default is at Remote.
Reference Frequency	0 to 255	Edit box with spin control	Selection of Apply	The reference frequency is generated by a 16.8 MHz Voltage Controlled Temperature Compensated Crystal Oscillator (VCTCXO). This VCTCXO provides the synthesizer with a frequency reference signal that it divides internally to produce the appropriate loop reference frequency. The reference frequency can be calibrated using the procedure outlined in Section 6.2.

Table 10-5. CM-300 UT/CM-350 UT Detail Window Controls (Contd)

Name	Limits	Control	Execution	Description
Summary Fault Status	N/A	List box	N/A	Display alarm/alert states when a monitored parameter is in transition. There are 2 columns in this list. First column contains the Alarm/Alert states. Second column contains the faults. Click on the column header to sort data in that column. For a radio, the following statuses are reported: Normal - Normal condition, transmitter operational. Alert - Some performance parameters degraded, transmitter still operational. Alarm - Performance severely degraded, transmitter operational status questionable. Failure - Transmitter not operational, requires immediate attention. For a transmitter, the following faults are reported: - +12 V - Exciter Over Temp - +26 V - PA Over Temp - +5 V - Modulation - 12 V - Output Power - 8 V - PTT - ALC - Synth1 Frequency - ATR - Tx Timeout - Elapsed Time
Factory Reset	N/A	Button	Immediate	Reset radio to factory default settings: Frequency (MHz) 225.000 RF Tuning Mode "Remote" Mod Index Level 80 Mod Limiter Level 255 Power Level 0 Lower Power Limit 0 Tx Timeout (sec) 35 ATR Relay Normal Remote PTT Off
Mod Index	0 to 255	Edit box	Selection	Set the radio mod index level.

Table 10-5. CM-300 UT/CM-350 UT Detail Window Controls (Contd)

Name	Limits	Control	Execution	Description
Level		with spin control	of Apply	This controls a digital potentiometer that establishes the ratio of the peak value of the modulating signal versus the peak value of the carrier signal at a given frequency and power level. Factory default is at 80.
Mod Limiter	0 to 255	Edit box with spin	Selection of Apply	Set the mod limiter level. This controls a digital potentiometer that
Level		control		establishes the maximum allowed modulation index of the RF signal at a given frequency and power level.
				Factory default is at 255.
Power	0 to pre-	Edit box	Selection	Set the radio power level.
Level	factory limit (255	•	of Apply	This controls a digital potentiometer that establishes the output power level of the RF signal.
	is max)			Factory default is at 0.
Lower	0 to 255	Edit box	Selection	Set the lower power limit.
Power Limit	Power with spin of A	of Apply	An ALERT fault will be generated if the output power does not exceed this threshold when the radio is transmitting.	
				Factory default is at 0.
Tx	CM-300	Edit box	Selection	Set the transmitter timeout value.
Timeout (sec)	UT – 5 to 300, CONT CM-350 UT – 5 to 60	with spin control	of Apply	This can be set in 5-second intervals. The "CONT" setting is only available for the CM-300 UT and represents no timeout. The maximum value (300) for the CM-300 UT represents a timeout of 5 minutes. The maximum value (60) for the CM-350 UT represents a timeout of 1 minute. If the radio is transmitting and reaches this limit, it will stop transmitting and generate an ALERT fault.
				Factory default is at 35 seconds.

Table 10-5. CM-300 UT/CM-350 UT Detail Window Controls (Contd)

Name	Limits	Control	Execution	Description
ATR	ATR Relay "Normal", "ATR1" or "ATR2" Drop- down list box	Selection	Set the ATR relay position.	
Relay			of Apply	When this is set to "Normal", the ATR common terminal (ATRC) is connected to ATR1 in the receive mode and switches to ATR2 when the radio is transmitting.
				When this is set to "ATR1", the ATR common terminal (ATRC) is always connected to ATR1.
				When this is set to "ATR2", the ATR common terminal (ATRC) is always connected to ATR2 as long as power is applied to the radio.
				Factory default is at Normal.
PTT Icon	N/A	Icon	N/A	This gives a visual indication of the status of the Remote PTT button. When the text is "Remote PTT On", the PTT icon changes to green (*) and when the text is "Remote PTT Off", the PTT icon changes to black (*)
				Factory default is at black.
Remote PTT	"On" or "Off"	Button	Immediate	Turn remote PTT "On" or "Off". This causes the radio to transmit. Text is toggled between "Remote PTT On" and "Remote PTT Off".
				Factory default is at Off.

<u>10.6.5.4</u> Front Panel Tab Operation. This section provides detailed descriptions for procedures that may be executed using the Front Panel tab. Some procedures, involving one or two steps and no more screens beyond the Front Panel tab screen, are considered self-explanatory. The functional description provided in Table 10-5 should be adequate.

The following procedures are provided:

- Set Frequency [MHz]
- Set the RF Tuning Mode
- Set Reference Oscillator Frequency
- Check Summary Fault Status and Current Status of Radio
- Reset to Factory Default Settings
- Set Mod Index Level
- Set Mod Limiter Level
- Set Power Level
- Set Lower Power Limit
- Set Tx Timeout (sec)
- Set ATR Relay
- Set Remote PTT On

NOTE

Error checking is applied when the OK or Apply button is clicked. There is minimal error checking when each input field is being edited. For example, input fields that require numerical values will not accept alpha characters. Input values are then validated against actual ranges/limits when they are about to be applied to the MDT.

When using the UHF MDT Software to make changes to the radio parameters, change one parameter at a time. Click on Apply (or OK) to apply the change before proceeding with further changes.

10.6.5.4.1 Set Frequency [MHz].- This procedure sets the radio's operating frequency. This input should be within the 225.000 to 399.975 MHz range (in 0.025 MHz increments). Values outside this range will not be accepted.

NOTE

The operating frequency may also be at the Radio Control window (see Section 10.6.4.1).

- 1. In the Front Panel tab, select Frequency [MHz] and make desired changes (Figure 10-25).
- 2. Click on Apply (or OK) to apply the changes to the MDT (see Section 10.6.5.2.2)

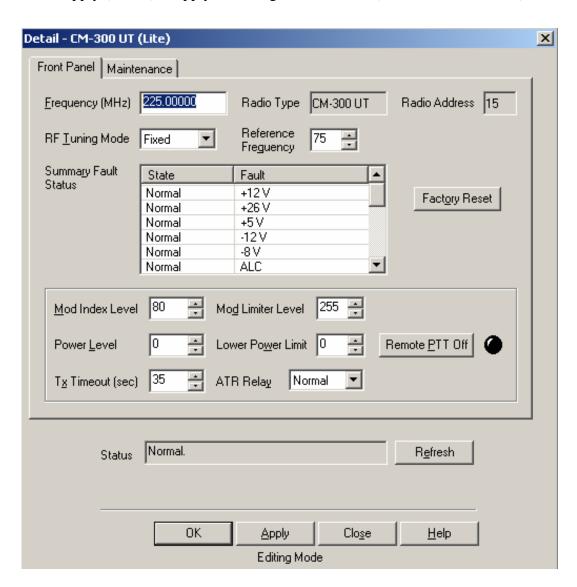


Figure 10-25. Set Frequency [MHz], Screen

<u>10.6.5.4.2</u> Set the RF Tuning Mode. This procedure selects either the Fixed Tuning Mode or the Remote Tuning Mode.

- 1. In the Front Panel tab, click on the pulldown menu of RF Tuning Mode.
- 2. Select the desired mode (Figure 10-26).
- 3. Click on Apply (or OK) to apply the changes to the MDT (see Section 10.6.5.2.2).

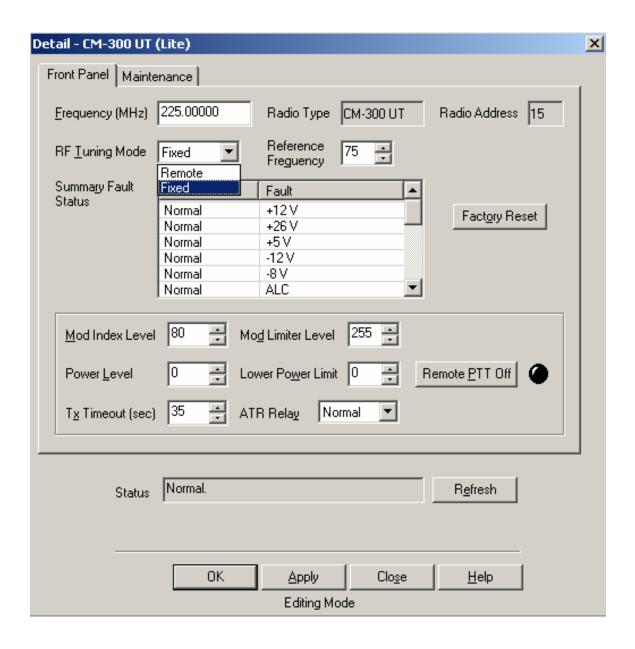


Figure 10-26. Set RF Tuning Mode, Screen

<u>10.6.5.4.3</u> Set Reference Frequency. The Reference Oscillator Frequency is preset at the factory in order to fine-tune the reference oscillator. If it should require adjustment, proceed as follows:

- 1. Refer to the procedure in Section 6.2 and perform the steps below in conjunction with the procedure in Section 6.2.
- 2. In the Front Panel tab, click on the up/down arrows of the Reference Frequency window to change the reference frequency (Figure 10-27). Increasing the value increases the reference frequency and decreasing the value decreases the reference frequency.
- 3. Click on Apply (or OK) to apply the changes to the MDT (see Section 10.6.5.2.2).

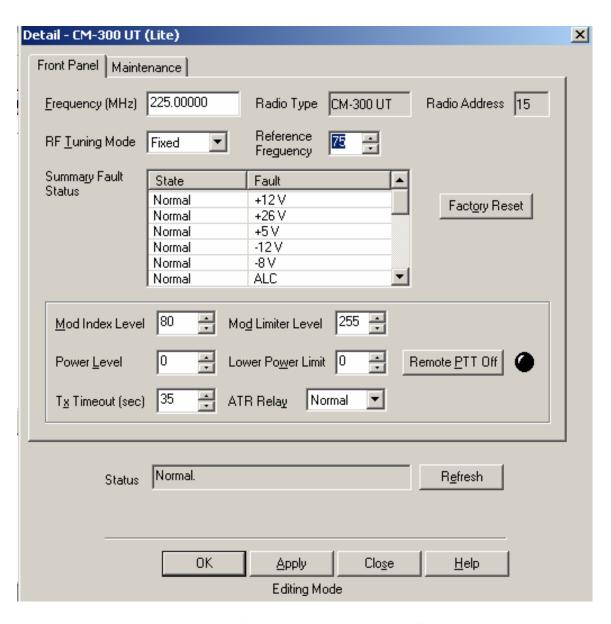


Figure 10-27. Set Reference Frequency, Screen

10.6.5.4.4 Check Summary Fault Status and Current Status of Radio. The Summary Fault Status displays alarm/alert states when a monitored parameter is in transition. There are 2 columns in this list. First column contains the Alarm/Alert states. Second column contains the Faults. Click on the column header to sort data in that column.

Current status of radio is displayed in the Status window and reflects the most critical status reported in the Summary Fault Status list. This status is also displayed in the Radio Control window (Figure 10-28).

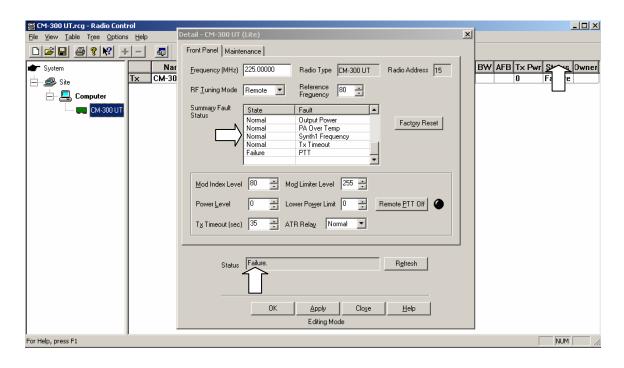


Figure 10-28. Check Summary Fault Status and Current Status of Radio, Screen

<u>10.6.5.4.5</u> Reset to Factory Default Settings.- This procedure will restore factory default settings.

- 1. In the Front Panel tab, click on the Factory Reset button.
- 2. The Front Panel returns the radio to factory default (Figure 10-29).

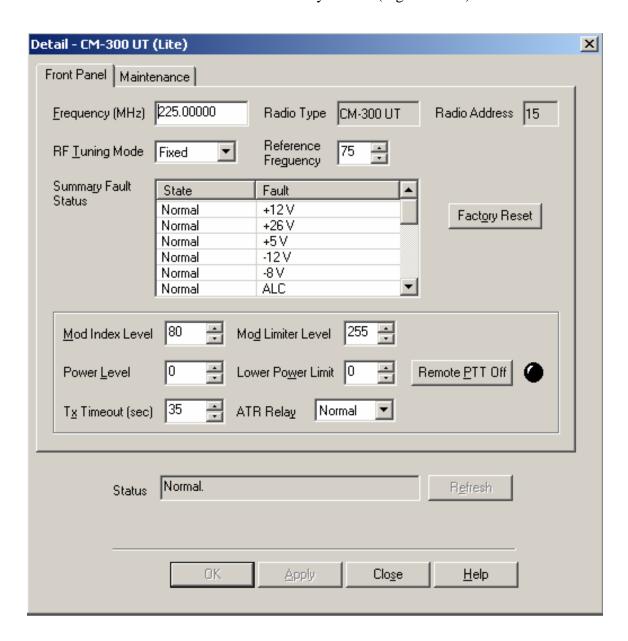


Figure 10-29. Reset to Factory Default Settings, Screen

10.6.5.4.6 Set Mod Index Level. This procedure will set the Mod Index Level. This controls a digital potentiometer that establishes the ratio of the peak value of the modulating signal versus the peak value of the carrier signal at a given frequency and power level. Factory default is at 80.

- 1. In the Front Panel tab, click on the up/down arrows of the Mod Index Level window to change the Mod Index Level (Figure 10-30).
- 2. Click on Apply (or OK) to apply the changes to the MDT (see Section 10.6.5.2.2).

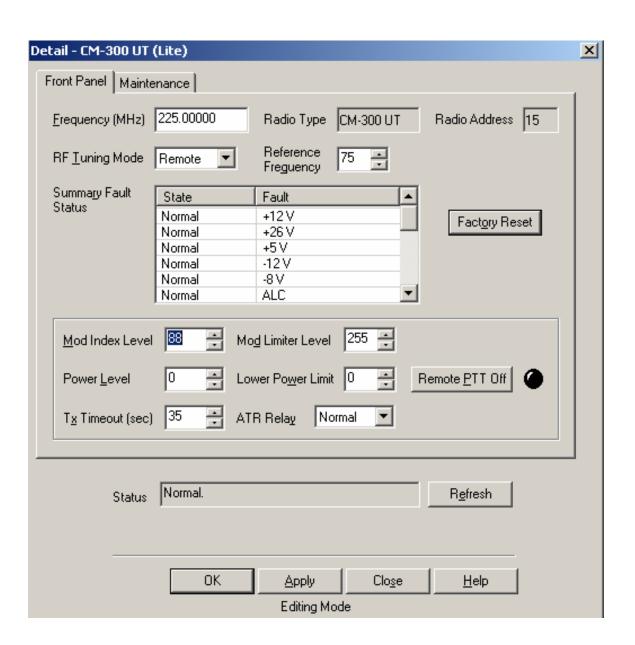


Figure 10-30. Set Mod Index Level, Screen

<u>10.6.5.4.7 Set Mod Limiter Level</u>.- This procedure will set the Mod Limiter Level. This controls a digital potentiometer that establishes the maximum allowed modulation index of the RF signal at a given frequency and power level. Factory default is at 255.

- 1. In the Front Panel tab, click on the up/down arrows of the Mod Limiter Level window to change the Mod Limiter Level (Figure 10-31).
- 2. Click on Apply (or OK) to apply the changes to the MDT (see Section 10.6.5.2.2).

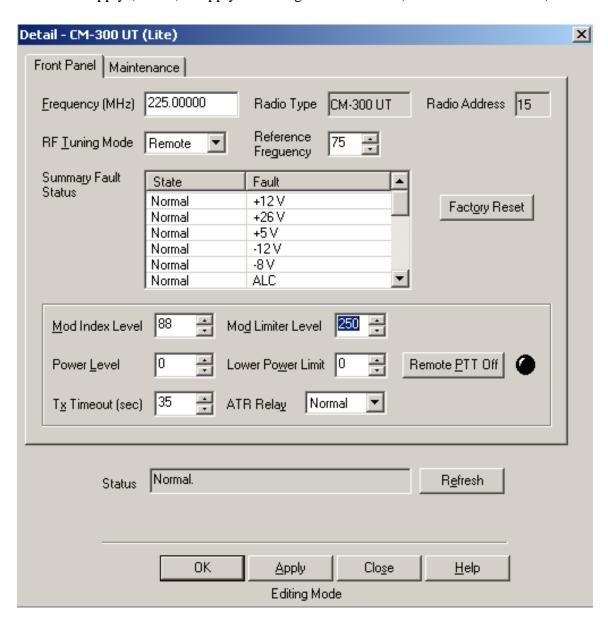


Figure 10-31. Set Mod Limiter Level, Screen

<u>10.6.5.4.8 Set Power Level.</u>- This procedure will set the Power Level. This controls a digital potentiometer that establishes the output power level of the RF signal. Factory default is at 0.

NOTE

The Power Level setting and Lower Power Limit are independent from each other.

- 1. In the Front Panel tab, click on the up/down arrows of the Power Level window to change the Power Level (Figure 10-32).
- 2. Click on Apply (or OK) to apply the changes to the MDT (see Section 10.6.5.2.2).

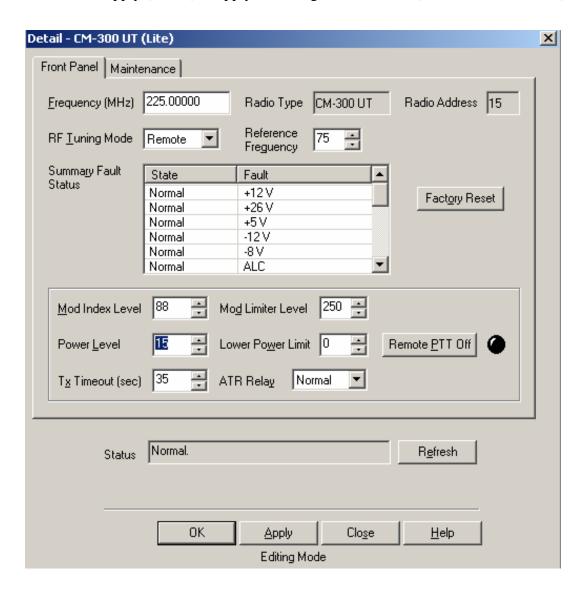


Figure 10-32. Set Power Level, Screen

<u>10.6.5.4.9 Set Lower Power Limit.</u>- This procedure will set Lower Power Limit. An ALERT fault will be generated if the output power does not exceed this threshold when the radio is transmitting. Factory default is at 0.

NOTE

The Power Level setting and Lower Power Limit are independent from each other.

- 1. In the Front Panel tab, click on the up/down arrows of the Lower Power Limit window to change the Lower Power Limit (Figure 10-33).
- 2. Click on Apply (or OK) to apply the changes to the MDT (see Section 10.6.5.2.2).

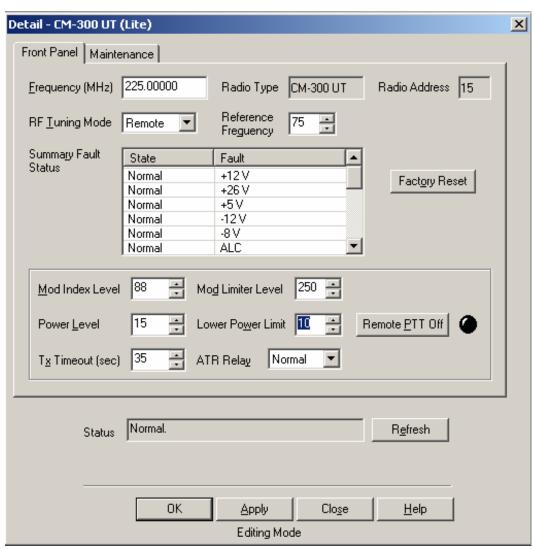


Figure 10-33. Set Lower Power Limit, Screen

10.6.5.4.10 Set Tx Timeout (sec). This procedure will set the Tx Timeout in seconds. This can be set in 5-second intervals. The "CONT" setting is only available for the CM-300 UT and represents no timeout. A setting of 300 for the CM-300 UT represents a timeout of 5 minutes. The maximum value (60) for the CM-350 UT represents a timeout of 1 minute. If the radio is transmitting and reaches this limit, it will return to receive mode and generate an ALERT fault. Factory default is at 35 seconds.

- 1. In the Front Panel tab, click on the up/down arrows of the Tx Timeout (sec) window to change the Tx Timeout (Figure 10-34).
- 2. Click on Apply (or OK) to apply the changes to the MDT (see Section 10.6.5.2.2).

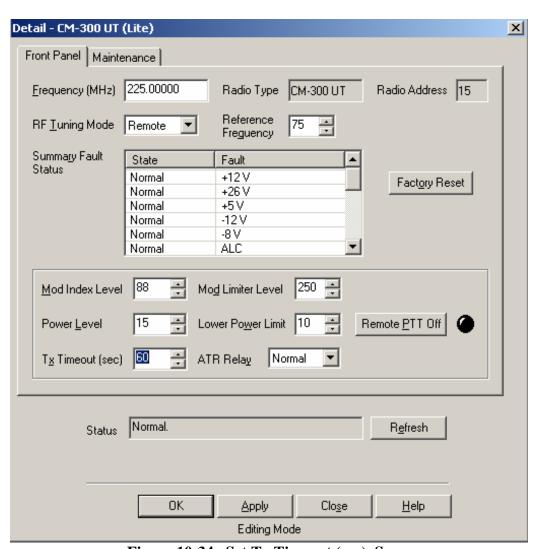


Figure 10-34. Set Tx Timeout (sec), Screen

10.6.5.4.11 Set ATR Relay. This procedure will set the ATR Relay to either Normal, ATR1, or ATR2. When this is set to "Normal", the ATR common terminal (ATRC) is connected to ATR1 in the receive mode and switches to ATR2 when the radio is transmitting. When this is set to ATR1, the ATR common terminal (ATRC) is always connected to ATR1. When this is set to ATR2, the ATR common terminal (ATRC) is always connected to ATR2 as long as power is applied to the radio. Factory default is at Normal.

- 1. In the Front Panel tab, click on the down arrow of the ATR Relay window and select the desired setting (Figure 10-35).
- 2. Click on Apply (or OK) to apply the changes to the MDT (see Section 10.6.5.2.2).

WARNING

If the ATR Relay is set from the MDT, it is imperative that it is returned to the Normal setting before disconnecting the MDT. If not, radio two-way communications will be disabled which may result in very serious consequences.

When the MDT reestablishes a connection, it cannot determine if the ATR Relay was asserted by the MDT in a previous session.

3. In the Front Panel tab, click on the down arrow of the ATR Relay window and select Normal to return to normal operation. Click on Apply (or OK) to apply the changes.

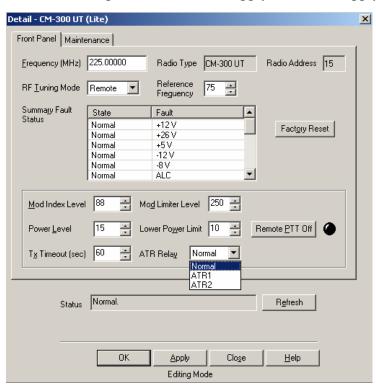


Figure 10-35. Set ATR Relay, Screen

<u>10.6.5.4.12</u> Set Remote PTT to On.- This procedure keys the radio remotely. This causes the radio to transmit. Factory default is at Remote PTT Off.

- 1. In the Front Panel tab, click on the Remote PTT Off button (Figure 10-36).
- 2. The button will change to Remote PTT On and the Remote PTT icon will turn green (Figure 10-36).

WARNING

If the PTT is set to On from the MDT, it is imperative that it is returned to the Off setting before disconnecting the MDT. If not, radio two-way communications will be disabled which may result in very serious consequences.

When the MDT reestablishes a connection, it cannot determine if the PTT was asserted by the MDT in a previous session.

3. In the Front Panel tab, click on the Remote PTT On button to return to the Remote PTT Off setting.

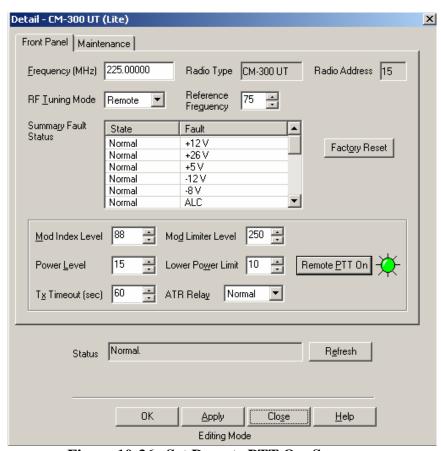


Figure 10-36. Set Remote PTT On, Screen

10.6.5.5 Maintenance Tab. The second tab on the Detail Window is the Maintenance tab. The Maintenance tab is shown in Figure 10-37 and its controls are described in Table 10-6. This tab is available for both receivers and transmitters.

Using the Maintenance tab, the user may

- Refresh the elapsed time (Section 10.6.5.6.1)
- Refresh total PTTs (Section 10.6.5.6.2)
- Refresh the event log (Section 10.6.5.6.3)
- Download software to the radio (Section 10.6.5.6.4)

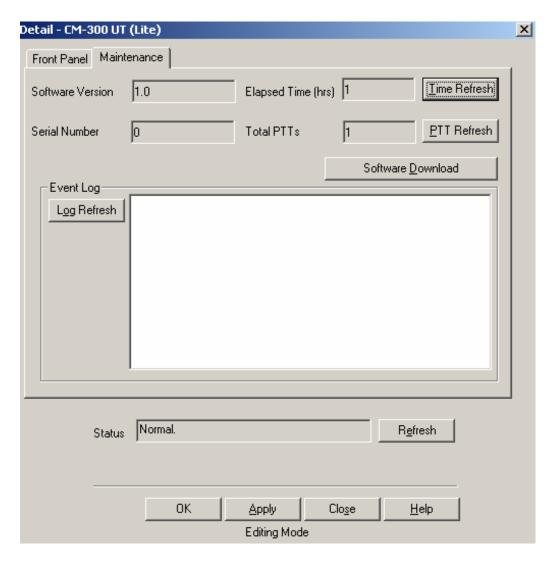


Figure 10-37. Maintenance Tab

Table 10-6. Maintenance Tab Controls

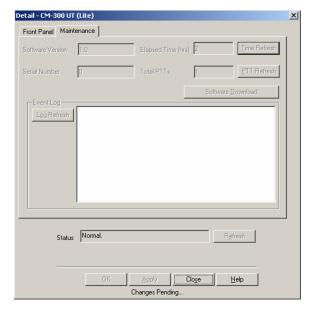
Name	Limits	Control	Execution	Description
Software Version	N/A	Static text control	N/A	Display the radio software version.
Serial Number	0 to 999999	Static text control	N/A	Display the radio's serial number.
Elapsed Time	N/A	Static text control	N/A	Radio's elapsed time after queried is displayed here. Elapsed time is displayed in hours format.
Time Refresh	N/A	Button	Immediate	Click to query the radio's elapsed time.
Total PTTs	N/A	Static text control	N/A	Radio's total number of PTTs after queried is displayed here. This control is grayed out if radio is a receiver.
PTT Refresh	N/A	Button	Immediate	Click to query the radio's total number of PTTs. This control is grayed out if radio is a receiver.
Log Refresh	N/A	Button	Immediate	Click to query the radio's event log. All events are updated each time button is clicked on.
Event Log	N/A	List box control	N/A	Radio's logs after queried are displayed here. Up to 100 entries are displayed.
Software Download	N/A	Button	Immediate	Click to download new radio software to the radio.

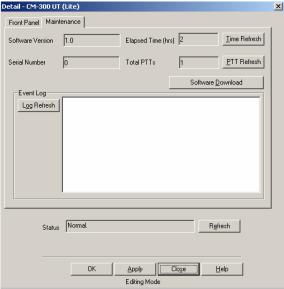
<u>10.6.5.6 Maintenance Tab Operation</u> .- This section describes procedures that may be executed using the Maintenance tab.

- Check Elapsed Time
- Check total PTTs
- Check Event Log
- Download Software

10.6.5.6.1 Check Elapsed Time [hrs].- This procedure checks the accumulated hours the radio has been operating. To display elapsed time, first do time refresh (Figure 10-38).

- 1. In the Maintenance tab window, click on Time Refresh.
- 2. The Maintenance tab momentarily goes into the Changes Pending mode while it is retrieving the latest elapsed time record.
- 3. The elapsed time is displayed and the Maintenance tab returns to normal.
- 4. Read elapsed time in hours in the Elapsed Time [hrs] window.





Changes Pending Mode

Elapsed Time Refresh

Figure 10-38. Check Elapsed Time, Screen

<u>10.6.5.6.2 Check Total PTTs</u>.- This procedure checks the total number of PTTs accumulated over the time the radio has been operating. To display the total number of PTTs, first do PTT Refresh (Figure 10-39).

- 1. In the Maintenance tab window, click on PTT Refresh.
- 2. The Maintenance tab momentarily goes into the Changes Pending mode while retrieving the latest PTT record.
- 3. The total number of PTTs is displayed and the Maintenance tab returns to normal.
- 4. Read total PTTs in the Total PTTs window.

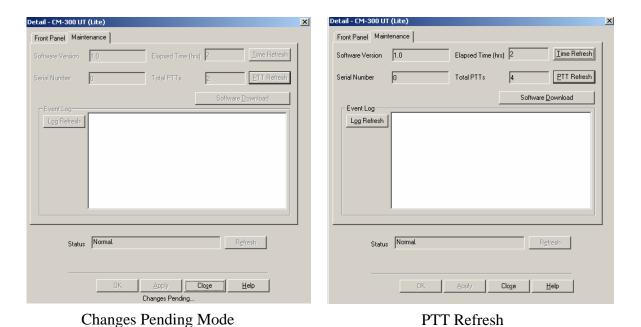


Figure 10-39. Check Total PTTs, Screen

<u>10.6.5.6.3</u> Check Event Log.- This procedure checks the event log of the radio. To display event log, first do Log Refresh.

- 1. In the Maintenance tab window, click on Log Refresh.
- 2. The Maintenance tab goes into the Changes Pending mode while retrieving the latest Event Log.
- 3. The Event Log is displayed and the Maintenance tab returns to normal.
- 4. Read Event Log in the event log window (see Figure 10-40 and Table 10-7).

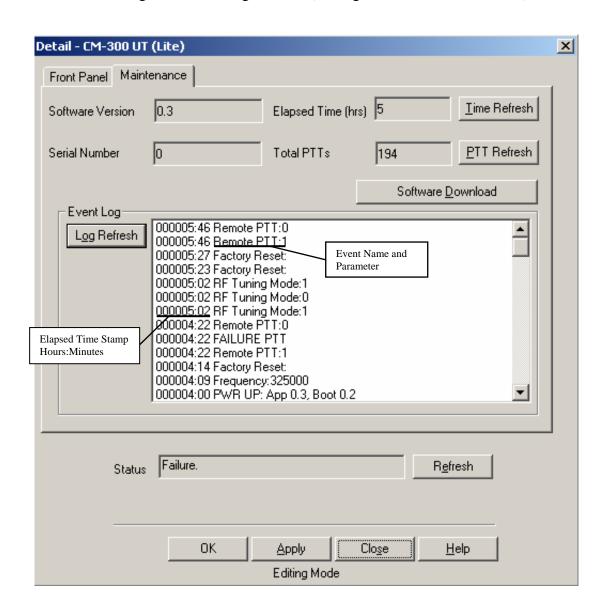


Figure 10-40. Check Event Log, Screen

NOTE

The Elapsed Time timer stores the hours in non-volatile memory however it does not store the minutes. In the event of a processor reset, the timer minutes are reinitialized back to 00. It begins counting up from that point until 59 minutes and then increments the hour counter. As a result, it is possible for an event that occurs chronologically later to have an Elapsed Time Stamp earlier than an event that occurred chronologically earlier than the current event.

NOTE

Some event log entries may be the result of the power-down bleed-off sequence and should not be considered critical. These events can be identified by the fact that they always preced a power up event log entry (PWR UP: App x.x, Boot y.y).

Table 10-7. Event Log Entries

Event Name	Description
ALARM +12 V	+12 Volts is outside of a factory set range.
NORMAL +12 V	+12 Volts has recovered from an ALARM condition.
ALARM -12 V	-12 Volts is outside of a factory set range.
NORMAL -12 V	-12 Volts has recovered from an ALARM condition.
ALARM +26 V	+26 Volts is outside of a factory set range.
NORMAL +26 V	+26 Volts has recovered from an ALARM condition.
ALARM -8 V	-8 Volts is outside of a factory set range.
NORMAL -8 V	-8 Volts has recovered from an ALARM condition.
ALARM +5 V	+5 Volts is outside of a factory set range.
NORMAL +5 V	+5 Volts has recovered from an ALARM condition.
FAILURE ALC	ALC Voltage is outside of a factory set range.
NORMAL ALC	ALC Voltage has recovered from an FAILURE condition.
ALARM ATR	ATR is not in the correct position.
NORMAL ATR	ATR has recovered from an ALARM condition.
FAILURE PTT	Radio has aborted a PTT sequence due to a fault condition

Table 10-7. Event Log Entries (Contd)

Event Name	Description
NORMAL PTT	Radio has recovered from a PTT FAILURE condition.
FAILURE Synth1 Frequency	Synth1 failed to lock on frequency.
NORMAL Synth1 Frequency	Synth1 has recovered from a FAILURE condition.
ALARM Exciter Over Temp	Internal temperature on the exciter board has exceeded the factory set threshold.
NORMAL Exciter Over Temp	Internal temperature on the exciter board has returned to within the normal expected range
ALARM PA Over Temp (CM-350)	Internal temperature on the PA board has exceeded the factory set threshold.
NORMAL PA Over Temp (CM-350)	Internal temperature on the PA board has returned to within the normal expected range
ALERT Output Power	Sensed RF output power is below the minimum factory set threshold.
NORMAL Output Power	Radio has recovered from a Output Power ALERT condition.
ALARM Modulation	Transmitter is in an overmodulation condition.
NORMAL Modulation	Transmitter has recovered from a modulation ALARM condition.
ALERT Elapsed Time	Elapsed time failed to update correctly.
NORMAL Elapsed Time	Elapsed time has recovered from an ALERT condition.
ALERT Tx Timeout	The Transmitter has exceeded the timeout limit and has been set to the receive mode.
NORMAL Tx Timeout	The Transmitter has recovered from a Tx Timeout ALERT.
PWR UP: App x.x, Boot y.y	Radio has powered up with Application SW Version x.x, and Boot SW Version y.y.
Software Download	A Software Download event has occurred.
Lower Power Limit:xxx	Lower Power Limit has changed to xxx.

Table 10-7. Event Log Entries (Contd)

Event Name	Description
Power Level:xxx	Power Level has changed to xxx.
Tx Timeout:xxx sec	Tx Timeout has changed to xxx seconds.
Mod Index Level:xxx	Mod Index Level has changed to xxx.
Remote PTT:xxx	Remote PTT function has changed to xxx where xxx is either "ON or "OFF".
Frequency:xxxxxx	Frequency has changed to xxxxxx kHz.
Factory Reset:	Factory Reset event has occurred.
ATR Relay:xxx	ATR Relay function has changed to xxx where xxx is either "Normal", "ATR1", or "ATR2".
Mod Limiter Level:xxx	Mod Limiter Level has changed to xxx
Noise Squelch:xxx	Noise Squelch function has changed to xxx where xxx is either "ON or "OFF".
RF Tuning Mode:xxxxxx	RF Tuning Mode has changed to xxxxxx where xxxxxx is either "Remote" or "Fixed".
Reference Frequency:xxx	Reference Frequency warp value has changed to xxx.

<u>10.6.5.6.4 Software Download</u>.- This procedure will download new software to the radio. Refer to the Maintenance tab (Figure 10-37) and proceed as follows:

NOTE

This is only possible through the local (front panel) MDT connector

- 1. Connect MDT to the local (front panel) MDT connector.
- 2. Insert CD containing the radio software in the CD ROM drive.
- 3. In the Maintenance tab, click on the Software Download button. A confirmation dialog is displayed (Figure 10-41).



Figure 10-41. Software Download Confirmation, Dialog Box

- 4. Read the CAUTION note carefully. If you feel ready press Yes to continue; if not, press No to return to the Maintenance tab.
- 5. If the Yes button in the above dialog is clicked, the Open dialog menu (Figure 10-42) is displayed.

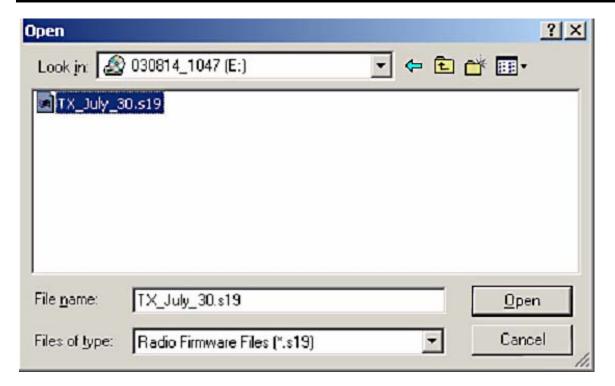


Figure 10-42. Software Download – File Open Dialog

- 6. In the Open dialog menu, look in the CD ROM folder and select the new software file (.s19 type) to be downloaded to radio.
- 7. Click on Open. The software download process is initiated and the Detail dialog will go into the Changes Pending mode (Figure 10-43).

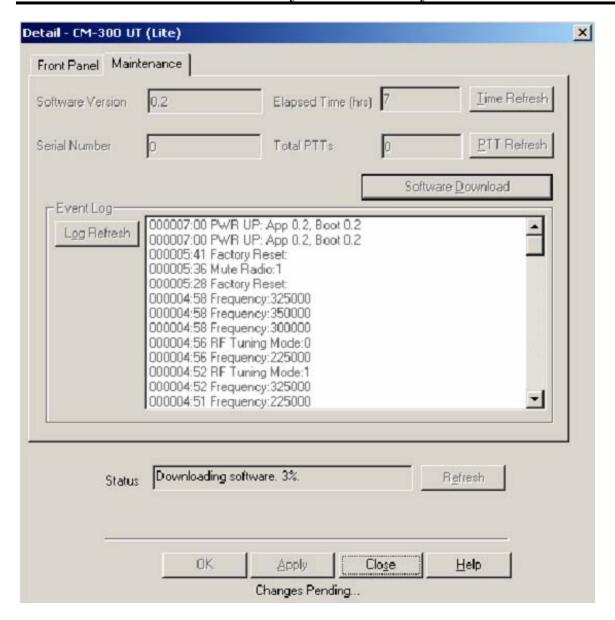


Figure 10-43. Software Download – Changes Pending Mode

8. The Changes Pending mode will remain until the software has been successfully downloaded, in which case it will display a message to that effect (Figure 10-44).



Figure 10-44. Software Download Successful Message

- 9. Click OK to return to the normal Maintenance tab.
- 10. If software download was unsuccessful, an error message will be displayed indicating the error encountered (Figure 10-45). Table 10-8 lists the messages that may be displayed in this dialog box.

NOTE

If software download was unsuccessful, it will revert back to the previous version of the software. In order to reinitialize this version, cycle power to the radio (switch power off and then on).



Figure 10-45. Software Download Unsuccessful Message

Table 10-8. Software Download Unsuccessful Messages

Message	Description	Corrective Action
"Error downloading software. Timeout waiting for radio to	Timeout waiting for a response from the radio.	Ensure the MDT interface cable is properly connected.
response. Software download is not successful."		Verify the CD-ROM is the correct CD-ROM, and that it is not damaged.
		Check that the minimum requirements for the system hardware are met.
"Error downloading software. Software file does not exist."	Software file does not exist.	Verify the CD-ROM is the correct CD-ROM, and that it is not damaged.
"Error downloading software. Software file is too large."	Software file is too large. File size is limited to 64k.	Check that the minimum requirements for the system hardware are met.
"Error downloading software. Not enough memory."	MDT software does not have enough memory to load the software file.	Check that the minimum requirements for the system hardware are met.
"Error downloading software. Error reading software file."	Error reading records from software file. File could be damaged.	Verify the CD-ROM is the correct CD-ROM, and that it is not damaged.
"Error downloading software. Error transferring software file."	Error transferring software file to a temporary location.	Check that the minimum requirements for the system hardware are met.
"Error downloading software. Error creating temporary file."	Error creating a temporary file from software file.	Check that the minimum requirements for the system hardware are met.
"Error downloading software. Software file has no records."	Software file has no valid records.	Verify the CD-ROM is the correct CD-ROM, and that it is not damaged.
"Error downloading software. Error in software file. Line does not start with 'S'."	Software file has records with invalid format. Line does not begin with 'S'.	Verify the CD-ROM is the correct CD-ROM, and that it is not damaged.

Table 10-8. Software Download Unsuccessful Messages (Contd)

Message	Description	Corrective Action
"Error downloading software. Error in software file. Line does not contain CRLF at end of S-record data."	Software file has records with invalid format. Line doesn't end with CRLF.	Verify the CD-ROM is the correct CD-ROM, and that it is not damaged.
"Error downloading software. Error in software file. Line does not contain a supported S- record."	Software file has records that the MDT software doesn't support.	Verify the CD-ROM is the correct CD-ROM, and that it is not damaged.
"Error downloading software. Error while downloading. Received a NAK response."	Receive a NAK from radio while downloading software.	Ensure the MDT interface cable is properly connected

<u>10.6.6 SHUTTING DOWN THE UHF MDT SOFTWARE</u>.- To shutdown the UHF MDT Software, perform the following steps:

1. Shutdown the UHF MDT Software by clicking the "X" button in the upper right corner of the CM-300 UT/CM-350 UT Control Window as shown in figure 10-46.

NOTE

Software shutdown is immediate. All changes made using the CM-300 UT/CM-350 UT Detail Window will be lost unless the apply button has been clicked.

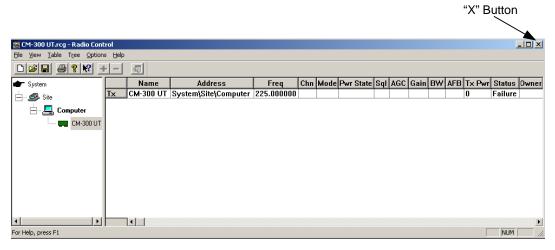


Figure 10-46. CM-300 UT/CM-350 UT Control Window for Shutdown

2. After clicking the "X" button all the UHF MDT Software windows will close, and the UHF MDT Software shutdown procedure is complete.

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APPENDIX A

SECOND LEVEL ENGINEERING SUPPORT AND WARRANTY SERVICE PROCEDURE

A.1 SECOND LEVEL ENGINEERING SUPPORT CONTACT INFORMATION. Second level engineering assistance to CM-300 equipment is provided by the OKC Communications Systems Engineering Support Branch, AOS-510. Contact the AOS-510 air-to-ground field support team using the following telephone numbers. This support is available 24 hours a day, seven days a week.

(405) 954-0066 – 0800 – 1600, Monday through Friday, Central Time

(405) 954-3583 – all other days and times (on duty for Emergencies Only)

<u>A.2 WARRANTY SERVICE PROCEDURE</u>.- The CM-300 Line Replaceable Units (LRU) below are covered by warranty. The warranty expiration date is shown on a label attached to the unit.

Item Name	Manufacturer Part Number	National Stock Number (NSN)
Transmitter, UHF (Low Power)	01-P40400G001	5895-01-505-7139
Transmitter, UHF (High Power)	01-P40200G001	6030-01-505-7163
UHF MDT S/W	99-P40681G	7025-01-505-7164

Table A-1. CM-300 LRUs Under Warranty

NOTE

Removing the radio cover will void the warranty resulting in delays in repair and additional expense. This equipment is not to be opened without prior authorization.

Warranty service procedures are as follows:

- Site With Failed LRU Place order for LRU replacement through the Logistics and Inventory System (LIS).
 - a. Go to LIS online requisitioning, select requisition entry screen and input the National Stock Number (NSN), Supply Support Code and Priority.
 - b. At that time you may ENTER or tab down to the OPTIONS area and enter the option #3 (Failure Under Warranty).
 - c. Input the serial number of the failed unit.

NOTE

Without this information, processing your requisition will be delayed until this information is provided.

- 2. FAA Logistics Storage Facility Ship serviceable LRU along with:
 - a. FAA Form 4650-10, WARRANTY FAILURE REPORT.
 - b. Prepaid shipping Fed/Ex label, to be used by the site to return the failed LRU to
 - c. General Dynamics for repair.
- 3. Site with failed LRU
 - a. Upon receipt of paperwork, complete the following blocks in FAA Form 4650-10 (see appropriate sample form, Figure A-1, A-2, or A-3):
 - DATE OF REPORT (today's date)
 - CONTROL NUMBER (reference OUTGOING VOUCHER NO. located on the SHIPPING ORDER, FAA FORM 4250-4).
 - #2 (Originator)
 - #3 (Phone)
 - #4 (Facility Address)
 - #18 (Serial Number)
 - #22 (Date Operative)
 - #23 (Date Failed)
 - #25 (Requisition No.)
 - #26 (Failure Narrative)
 - b. Return the repairable asset to General Dynamics using the preprinted FedEx label. Include a copy of the completed FAA Form 4650-10 form with the shipment and maintain a copy for your records.

CAUTION

If possible, pack the equipment in the original shipping container using the original packing material. Otherwise, pack the equipment in accordance with best commercial practices to ensure safe return to General Dynamics.

- 4. General Dynamics
 - a. If all information is in order, repair failed LRU and return serviceable unit to the FAA Logistics Storage Facility.
 - b. If returned LRU is found to be out of warranty, contact the FAA Logistics Storage Facility.

U.S. DEPARTMENT OF TRANSPORTATION DATE OF I			REPORT	-	CONTROL	NUMBI	ER (DEPOT USE)		
WARRANTY FAILURE REPORT			REQU	IIRED		R	EQUIRED		
PART I – FACILITY DATA						PART II – EQUIPME	NT DATA		
1.	Facility Repo					6. Name (System/F			7. FA Type No.
	Originator QUIRED		3. Phone FTS:	9		8. Manufacturer			9. Serial No.
	Facility Addres	• •	Comn	n: REQUIR	ED	10. Date Received		11.	Date Operative
	QUIRED					12. Date Failed		13.	Date Warranty Exp.
						14. Contract/Order N	lo. (Equipr	nent)	
5. DT	Contract No./(FA01-03-C-00	Order No. <i>(Ap</i>) 0035	plicable to	failed items)					
	RT III – FAIL		ENT DATA	A (Above Eg	uipmen	t Only)			
I T	15.Part No. 01-P404000				MITTER,	UHF (LOW POWER)	17. Mani GENER	AL DY	YNAMICS
M	18. Serial N REQUIRED			19. Ref.	Designa	tion	5895-01	-505-7	
0	21. Qty. 1	22. Date Op		•	REQUI				ranty Exp.
	RQN.NO.: R DATE: PRIORITY:)epot?		26. Fai REQUI	ilure Narrative - Hours RED	Operation		
	IF NOT REASO	ON VVHY:							
ļ	15. Part No.			16. Nour	17. Manufacturer			turer	
E M	18. Serial N	0.		19. Ref.	Designa	tion	20. National Stock No.		Stock No.
N 0	21. Qty.	22. Date Op	erative		23. Da	Date Failed 24. Date Warranty Exp.		rranty Exp.	
25. Replace. Rqn. From Depot? RQN. NO.: DATE: PRIORITY: IF NOT REASON WHY:			26. Fai	llure Narrative - Hours	Operation				
27	. Additional Ci	omments							
		omonto							
L									
FΔ	å Form 4650.40	(11-75) SUPERSED	DES PREMOUS	S EDITION (comp.)	ter generat	ad form)			

Figure A-1. FAA Form 4650-10 for CM-300 UT, UHF Transmitter (low power)

U.S. DEPARTMENT OF TRANSPORTATION DATE OF F			EPORT CONTROL		CONTROL	NTROL NUMBER (DEPOT USE)			
WARRANTY FAILURE REPORT			REQUIRED REQUIRED			EQUIRED			
PART I – FACILITY DATA						PART II – EQUIPME	NT DATA		
1.	Facility Report					6. Name (System/F			7. FA Type No.
	2. Originator 3. Phone FTS:					8. Manufacturer			9. Serial No.
	acility Address		Comn	n: REQUIR	ED	10. Date Received		11.	Date Operative
	QUIRED					12. Date Failed		13.	Date Warranty Exp.
						14. Contract/Order N	No. (Equipn	nent)	
	Contract No./Or FA01-03-C-000		plicable to	failed items)					
	RT III – FAILEI		ENT DATA	A (Above Ea	uiomen	t Only)			
ļ	15.Part No. 01-P40200G0			16. Nour)	UHF (HIGH POWER)	17. Manu GENER		irer YNAMICS
M M	18. Serial No. REQUIRED			19. Ref.	Designa	tion	20. Natio 6030-01-		
0	1	22. Date Op		'	REQUI			Warr	ranty Exp.
	25. Replace. F RQN. NO.: REI DATE: PRIORITY:		epot?		26. Fai REQUI	lure Narrative - Hours RED	Operation		
	IF NOT REASON	WHY:							
I T					17. Manufacturer			turer	
M	18. Serial No.			19. Ref.	Designation 20. Nation			onal :	Stock No.
0	21. Qty. 2	22. Date Op	erative		23. Da	te Failed	24. Date	:War	rranty Exp.
	25. Replace. R RQN. NO.: DATE: PRIORITY: IF NOT REASONY		epot?		26. Fai	lure Narrative - Hours	Operation		
27.	Additional Con	nments							
FΔ	A Form 4650-10 (11	.76\QHBEDQEF	DES BREMOUS	S EDITION (comp.)	tter generati	ad farm)			

Figure A-2. FAA Form 4650-10 for CM-350UT, UHF Transmitter (high power)

U.S. DEPARTMENT OF TRANSPORTATION DATE C			DATE OF F)F REPORT		CONTROL NUMBER (DEPOT USE)			
WARRANTY FAILURE REPORT			REQUIRED		REQUIRED				
PART I – FACILITY DATA						PART II – EQUIPM	ENT DATA		
1.	Facility Repo					6. Name (System/i			7. FA Type No.
	. Originator 3. Phone EQUIRED FTS:					8. Manufacturer			9. Serial No.
	acility Address		Comn	n: REQUIR	ED	10. Date Received		11.	Date Operative
	QUIRED	,				12. Date Failed		13.	Date Warranty Exp.
						14. Contract/Order I	No. (Equipr	ment)	
	Contract No./C FA01-03-C-00		plicable to	failed items)		-			
	RT III – FAILE		ENT DATA	\ (Above Eq	uipmen	t Only)			
I T	15.Part No. 99-P40681G			16. Nour	1	Software)	17. Man GENER		rer NAMICS
M 	18. Serial No REQUIRED			19. Ref.	Designa	tion	20. Natio	-505-7	⁷ 164
N 0	21. Qty. 1	22. Date Op		·	REQUI				anty Exp.
	25. Replace. RQN. NO.: RI DATE: PRIORITY:		epot?		26. Fai REQUI	ilure Narrative - Hours IRED	Operation	I	
	IF NOT REASO	N WHY:							
1	15. Part No.			16. Nour	1		17. Mar	nufacti	urer
E M	18. Serial No	l.		19. Ref.	Designa	tion	20. Nati	ional S	Stock No.
N 0	21. Qty.	22. Date Op	erative		23. Da	23. Date Failed 24. Date		e War	ranty Exp.
25. Replace. Rqn. From Depot? RQN. NO.: DATE: PRIORITY: IF NOT REASON WHY:				26. Fai	ilure Narrative - Hours	Operation	ı		
27.	<u> </u> . Additional Co	mments							
FA	A Form 4650-10 (11-75) SUPERSE	DES PREMOUS	S EDITION (como	tter denerat	ed form)			

Figure A-3. FAA Form 4650-10 for UHF MDT Software

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APPENDIX E GLOSSARY OF TERMS, ACRONYMS AND ABBREVIATIONS

<u>B.1 GLOSSARY OF TERMS</u>.- A list of glossary of terms and their descriptions are listed below.

GLOSSARY	DESCRIPTION
Amplitude Modulation	In Amplitude Modulation, the carrier frequency is modulated by the amplitude of the audio signal.
Elapsed Time	The accumulated hours that the radio has been operating.
Factory Reset	The Factory Reset operation resets the receiver back to its factory default settings.
Fixed Tuning Mode	In the Fixed Tuning Mode, the RF input signal is routed through an internal (or external) cavity filter for manual tuning.
Frequency Modulation	In Frequency Modulation, the carrier frequency is modulated by the frequency of the audio signal.
Lower Power Limit	The output power should be over this limit. An ALERT fault will be generated if the output power does not exceed this threshold when the radio is transmitting.
Mod Index Level	This is the ratio of the peak value of the modulating signal versus the peak value of the carrier signal at a given frequency and power level.
Mod Limiter Level	This controls a digital potentiometer that establishes the maximum allowed modulation index of the RF signal at a given frequency and power level.
Power Level	This controls a digital potentiometer that establishes the output power level of the RF signal.
Radio Address	Radio address is configured by the binary state of pins 1, 2, 9, and 10 of the REM INT connector. This address must be included in the configuration of each radio.

GLOSSARY	DESCRIPTION
Reference Frequency	The reference frequency is generated by a 16.8 MHz Voltage Controlled Temperature Compensated Crystal Oscillator (VCTCXO). This VCTCXO provides the reference frequency to both Local Oscillators. The reference frequency can be calibrated using the procedure outlined in Section 6.2.
Remote Tuning Mode	In RemoteTuning Mode, an internal (or external) cavity filter is not used. The RF input signal is routed through internal Voltage Tuned Filters (VTF) which may be remotely tuned through the MDT.

<u>B.2 ACRONYMS AND ABBREVIATIONS</u>: - A list of acronyms and abbreviations and their descriptions are listed below.

ACRONYM/

ABBREVIATION	<u>TERM</u>
A/D	Analog to Digital
AC	Alternating Current
AFB	Alternate Frequency Band
AGC	Automatic Gain Control
ALC	Automatic Level Control
AM	Amplitude Modulation
ATC	Air Traffic Control
ATR	Antenna Transfer Relay
BP	Bandpass
BW	Bandwidth
CBI	Computer Based Instruction
CD	Compact Disc
COM Port	Communication Port
CW	Continuous Wave
D/A	Digital to Analog
dB	Decibels
dBC	Decibels (referenced to carrier level)
dBm	Decibels (referenced to 1 milliwatt)
DC	Direct Current
DIP	Dual In-line Package
DIV	Division
DVM	Digital Voltmeter
FAA	Federal Aviation Administration

ACRONYM/

ABBREVIATION TERM

Freq Frequency

GND Ground

GUI Graphic User Interface

IC Integrated Circuit

IF, I.F. Intermediate Frequency

kHz Kilohertz

LCD Liquid Crystal Display

LED Light Emitting Diode

LIS Logistics and Inventory System

LNA Low Noise Amplifier

LO, L.O. Local Oscillator

LPF Low Pass Filter

LRU Lowest Replaceable Unit/Line Replaceable Unit

MDT Maintenance Data Terminal

MHz Megahertz

MIC Microphone

MM Millimeter/Multi Media

ms Milliseconds

MSL Mean Sea Level

mV Millivolts

mVp-p Millivolts/voltage Peak-to-peak

mW Milliwatts

NC Normally Closed/Not Completed

N/C No Connection

NO Normally Open

ACRONYM/

ABBREVIATION TERM

NSN National Stock Number

OJT On Job Training

PA Power Amplifier

PLL Phase-Locked-Loop

PPM Parts Per Million

PTT Push To Talk

PWB Printed Wiring Board

PWR Power

REF MON Reference Monitor

RF Radio Frequency

RMM Remote Maintenance Monitor

ROM Read Only Memory

us Microseconds

S/N Signal-to-Noise

STD Standard

SW Software

TIB Technical Instruction Book

UHF Ultra High Frequency

UR/UT UHF Receiver/UHF Transmitter

μV Microvolts

VAC, Vac Alternating Current Volts/Voltage

VCA Voltage Controlled Attenuator

VCO Voltage Controlled Oscillator

VCTCXO Voltage Controlled Temperature Compensated Crystal

Oscillator

VDC, Vdc Direct Current Volts/Voltage

ACRONYM/

ABBREVIATION TERM

Vp-p Volts/Voltage Peak-to-peak

Vrms Voltage Root Mean Squared

VSWR Voltage Standing Wave Radio

VTF Voltage Tuned Filter

W Watts

APPENDIX C dBm CONVERSION TABLES

C.1 dBm TO WATTS CONVERSION.- Table C-1 shows the dBm to Watts conversion.

Table C-1. dBm to Watts Conversion

dBm	Watts	dBm	Watts
30.0	1.0	39.0	7.9
30.5	1.1	39.5	8.9
31.0	1.3	40.0	10.0
31.5	1.4	40.5	11.2
32.0	1.6	41.0	12.6
32.5	1.8	41.5	14.1
33.0	2.0	42.0	15.8
33.5	2.2	42.5	17.8
34.0	2.5	43.0	20.0
34.5	2.8	43.5	22.4
35.0	3.2	44.0	25.1
35.5	3.5	44.5	28.2
36.0	4.0	45.0	31.6
36.5	4.5	45.5	35.5
37.0	5.0	46.0	39.8
37.5	5.6	46.5	44.7
38.0	6.3	47.0	50.1
38.5	7.1	47.5	56.2

C.2 dBm TO μV CONVERSION.- Table C-2 shows the dBm to Microvolts conversion.

Table C-2. dBm to μV Conversion

dBm	μV	dBm	μV
-110.0	.707	-100.0	2.24
-109.5	.749	-99.5	2.37
-109.0	.793	-99.0	2.51
-108.5	.840	-98.5	2.66
-108.0	.890	-98.0	2.82
-107.5	.943	-97.5	2.98
-107.0	1.00	-97.0	3.16
-106.5	1.06	-96.5	3.35
-106.0	1.12	-96.0	3.54
-105.5	1.19	-95.5	3.75
-105.0	1.26	-95.0	3.98
-104.5	1.33	-94.5	4.21
-104.0	1.41	-94.0	4.46
-103.5	1.49	-93.5	4.73
-103.0	1.58	-93.0	5.01
-102.5	1.68	-92.5	5.30
-102.0	1.78	-92.0	5.62
-101.5	1.88	-91.5	5.95
-101.0	1.99	-91.0	6.30
-100.5	2.11	-90.5	6.68